DATE: August 19, 2021

TO: SJVUAPCD Governing Board

FROM: Samir Sheikh, Executive Director/APCO
Project Coordinator: Jonathan Klassen

RE: **ITEM NUMBER 12: ADOPT PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES)**

RECOMMENDATIONS:

1. Adopt proposed amendments to Rule 4702 (Internal Combustion Engines).

2. Authorize the Chair to sign the attached Resolution.

BACKGROUND:

The *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (*2018 PM2.5 Plan*, or Plan) was adopted by your Board on November 15, 2018. The development of the *2018 PM2.5 Plan* utilized extensive science and research, state of the art air quality modeling, and the best available information in developing a strategy for bringing the Valley into attainment with the federal health-based 1997, 2006, and 2012 PM2.5 National Ambient Air Quality Standards (NAAQS, or standards) as expeditiously as practicable by the respective federal deadlines of 2020, 2024, and 2025. The attainment strategy in the Plan includes a combination of innovative regulatory and non-regulatory measures for both stationary and mobile sources that built upon stringent air quality measures already in place from earlier District attainment plans and measures adopted by your Board. The *2018 PM2.5 Plan* was developed through an extensive public process, with wide-ranging input and support from involved parties representing environmental, business, and community interests. Among these measures is a commitment from the District to seek additional emission reductions from internal combustion (IC) engines through amendments to District Rule 4702.

Today's proposed amendments to Rule 4702 include even more stringent nitrogen oxide (NOx) and volatile organic compounds (VOC) emission limits for IC engines operating in the Valley, as well as establishing particulate matter (PM) control requirements. Additionally, the proposed regulatory amendments satisfy the District's control measure commitment in the District's *2018 PM2.5 Plan* as well as Best Available Retrofit Control Technology (BARCT) requirements under AB 617. The purpose of this item is to seek your Board's approval of the proposed amendments to District Rule 4702.

DISCUSSION:

Internal Combustion engines operate by compressing and igniting a combustible mixture of fuel and oxygen, in the combustion chamber of the engine. The main types of engines are spark-ignited engines and compression-ignited (or diesel) engines. Spark-ignited engines use a spark plug to ignite the air/fuel mixture, and may use a variety of volatile fuels. Compression-ignited engines rely on heating of the inducted air during the compression stroke to ignite injected fuel, usually diesel fuel. IC engines may operate as either "rich-burn" or "lean-burn" engines. Rich-burn IC engines operate with an air to fuel ratio that results in stoichiometric or very near stoichiometric combustion of the fuel, and have little excess oxygen in the exhaust. Lean-burn engines combust fuel with excess air and have higher concentrations of oxygen in the exhaust. Engines are used by a variety of private businesses and public agencies throughout the Valley including schools and universities, agriculture, oil and gas production and pipelines, petroleum refining, and water districts. Many of the permitted compression-ignited engines in the District are emergency standby engines that provide backup power when electric service is interrupted.

Rule 4702 was adopted on August 2003, and has been amended several times, in June 2005, April 2006, January 2007, August 2011, and November 2013, to establish increasingly stringent NOx, CO, and VOC emission limits that units must comply with to operate in the District. As part of these regulatory efforts, hundreds of engines in the Valley have been equipped with the best available NOx and VOC control technologies. Through the requirements of Rule 4702, NOx emissions from non-agricultural and agricultural engines subject to these rules have been reduced by 85-96% and 84% respectively to date. As illustrative in Table 1, the proposed amendments achieve significant additional emissions reductions by 2024 and 2030.

Table 1 Estimated Emission Reductions for Compliance Years

Pollutant	2024 Emission Reductions (tpd)	2030 Emission Reductions (tpd)
NOx	0.62	0.70
VOC	0.31	0.32

Control Technology for IC Engines

Emissions from IC engines have been reduced through a variety of control technologies and practices, including exhaust control technologies, electrification of engines where feasible, and other practices. The primary method of controlling exhaust NOx emissions from IC engines is to install either a selective catalytic reduction (SCR) system or a non-selective catalytic reduction (NSCR) system to reduce NOx formation, depending on the air-to-fuel ratio with which the engine is operated. NSCR systems are also effective at reducing emissions of VOCs, while SCR systems require an additional oxidization catalyst for VOC control. These controls treat the pollutants formed before they are emitted into the atmosphere. SCR systems are typically more expensive than NSCR systems, and have a high annual operations and maintenance cost associated with the reagent used as a part of the control system. Due to these factors, SCR systems may not be a cost-effective control system for many lean-burn engines, such as the typical size range IC engines used in agricultural operations. NSCR systems are typically less expensive than retrofitting a unit with an SCR system, and have lower operations and maintenance costs, providing a cost-effective method of emissions control for rich-burn engines.

Summary of Proposed Amendments to Rule 4702

Today's proposed rule amendments would lower emission limits for NOx and VOCs for several categories of engines, and would establish PM requirements for IC engines operated in the Valley, as well as SOx control requirements for agricultural engines. Emissions limits were proposed based on the results of a comprehensive review of the existing engine inventory in the Valley, available control technology (including what is currently required for BACT), requirements in other air districts, and a cost-effectiveness analysis of requiring further controls for existing engines (as further discussed in Appendix C of the attached Staff Report). The proposed emission limits for each category of engine are included in Table 3 and Table 5 of the rule, shown below.

Rule 4702 Table 3 - Emission Limits for a Spark-Ignited Internal Combustion Engine Rated at >50 bhp Used Exclusively in Non-AO			
Engine Type	NOx Limit (ppmv)	CO Limit (ppmv)	VOC Limit (ppmv)
1. Rich-Burn			
a. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	11	2000	90
b. Cyclic Loaded, Field Gas Fueled	11	2000	90
c. Limited Use	11	2000	90
d. Rich-Burn Engine, not listed above	11	2000	90
2. Lean-Burn Engines			
a. Limited Use	11	2000	90

Rule 4702 Table 3 - Emission Limits for a Spark-Ignited Internal Combustion Engine Rated at >50 bhp Used Exclusively in Non-AO			
Engine Type	NOx Limit (ppmv)	CO Limit (ppmv)	VOC Limit (ppmv)
b Lean-Burn Engine used for gas compression	40	2000	90
c. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	40	2000	90
d. Lean-Burn Engine, not listed above	11	2000	90

Rule 4702 Table 5 - Emission Limits/Standards for a Spark-Ignited Internal Combustion Engine >50 bhp Used Exclusively in AO			
Engine Type	NOx Limit	CO Limit (ppmv)	VOC Limit (ppmv)
1. Rich-Burn	0.15 g/bhp-hr or 11 ppmv	2000	90
2. Lean-Burn	0.6 g/bhp-hr or 43 ppmv	2000	90

Proposed amendments would add language to reference control requirements for both AO and Non-AO Spark-Ignited engines, and associated compliance timelines. The proposed compliance schedule for non-AO spark-ignited engines would take place over 2.5 years, with full compliance with emissions limits required by December 31, 2023. Operators of AO spark-ignited rich-burn engines would have until December 31, 2023, to bring their engines into full compliance with proposed emissions limits. Operators with AO lean-burn engines would have to be in full compliance with new emissions limits by December 31, 2029, or 12 years after installation of the unit, whichever comes later, to allow for the full useful life of the equipment to be met. District staff are proposing to remove the current option in the rule to pay a compliance fee in lieu of meeting the existing emissions limits. In order to allow time for the few operators that currently comply with the rule through this provision to retrofit or replace their equipment to meet the proposed limits, this compliance option is proposed to sunset at the end of 2023.

Sulfur Oxides emission control requirements for agricultural engines will be established to be consistent with requirements for non-AO engines. In addition, a provision has been added to this section whereby agricultural engines fueled with digester gas which are installed before December 31, 2021, must limit their fuel sulfur content. All other agricultural engine types must either limit their gaseous fuel sulfur content, or install and properly operate an emission control system that reduces SO_2 emissions by at least 95% by weight.

A Particulate Matter Emission Control Requirements section would be added to the rule to establish PM requirements for IC engines operated in the Valley. For spark-ignited engines, SOx and PM emission controls are dependent on the amount of sulfur content in the fuel, and so the PM control requirements for spark-ignited engines would be

based on SOx requirements. EPA Tier certification standards require that the majority of Tier 4 interim and all Tier 4 final diesel engines have a Diesel Particulate Filter, or DPF, installed for PM control. In the proposed rule, compression-ignited engines would continue to be required to comply with the applicable CARB/EPA Tier certification standard, whereby the engines are required to install the cleanest tier engine available at the time of installation.

Health Benefits of Implementing Plan Measures

Exposure to PM2.5 and ozone has been linked to a variety of health issues, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. PM2.5 is a major health risk because it can be inhaled more deeply into the gas exchange tissues of the lungs, where it can be absorbed into the bloodstream and carried to other parts of the body. Studies have shown that even short-term exposure of less than 24 hours can cause premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5 and ozone.

As NOx emissions are a key precursor in the formation of both ozone and PM2.5, continuing to assess the feasibility of achieving additional NOx reductions across the Valley is critical to improving PM2.5 and ozone throughout the region. PM2.5 emissions are characterized by a unique combination of direct and indirectly formed constituents. NOx emissions are a precursor to the formation of ammonium nitrate, which is a large portion of total PM2.5 during the Valley's peak winter season. NOx is also a precursor to ozone, which is formed when heat and sunlight interact with NOx and VOCs. Harmful ozone is predominantly formed at the surface during the summer season in the Valley. The District has long worked to reduce NOx emissions as the primary precursor for the formation of ozone and PM2.5 in the Valley.

To address federal health-based standards for ozone and PM2.5 and improve public health, the District develops attainment plans and implements control measures to lower direct and precursor emissions throughout the San Joaquin Valley. The proposed amendments will achieve additional reductions in NOx emissions as requirements are implemented by affected sources, and new technologies are installed. New regulatory and incentive-based measures proposed by both the District and CARB, combined with existing measures achieving new emissions reductions, are necessary to attain the health-based federal standards as expeditiously as practicable, and will improve public health as emissions reductions are realized.

COVID-19 Pandemic Considerations

The COVID-19 pandemic is first and foremost a human tragedy, which has sent society into uncharted territory, and the economic impacts to the United States and the world are significant and far-reaching. The Valley and nation are currently facing uncertain economic times that have the potential to be devastating to local Valley businesses and residents. As an essential public health agency and member of the Valley community, the District has a responsibility to continue providing essential public services while keeping our employees and our communities safe. As the COVID-19 situation continues to evolve, the District has remained open, providing essential services to the residents, businesses, and public agencies of the Valley through virtual tools and direct support from our employees working remotely. District staff also understand the major disruption to the Valley and nation's economy caused by the COVID-19 pandemic; and have committed to work closely with those that we regulate to understand the evolving situation and associated impacts, and develop options for meeting air quality obligations.

In response to COVID-19, the District has modified public participation process to ensure continued development of measures included in District commitments in the federally approved *2018 PM2.5 Plan*. Beginning in March 2020, the District transitioned public workshop processes for this rule project to virtual online webinars with multiple options for public participation including video, phone, and email, with full translation services provided at public meetings. The District has continued to hold public workshops and to meet directly with stakeholders through virtual meeting tools throughout the pandemic to enable robust remote public participation.

Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, the socioeconomic impact analysis conducted for this rule uses a "COVID-adjusted baseline" for these metrics, with details presented in Appendix D to the Final Draft Staff Report.

While the pandemic has had far-reaching economic impacts, it is critical that the Valley continue to make progress towards attainment of the health-based federal ambient air quality standards. The health benefits of improved air quality, and the associated economic benefits, have been well documented. District staff have worked to develop proposed amendments to this rule that provides as much flexibility to affected industry as possible, while still ensuring that real emission reductions will be achieved to support increased air quality, and associated benefits to public health, throughout the Valley.

Supporting Regulatory Analyses

Cost Effectiveness Analysis

California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each BARCT rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. Cost effectiveness will depend on the current level of controls, unit size, fuel usage and final emission levels. Details of the cost effectiveness analysis is contained in Appendix C of the staff report.

Socioeconomic Impact Analysis

Pursuant to CH&SC Section 40728.5, "whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available; perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation." The socioeconomic analysis has been used to further refine the rule amendments. The final socioeconomic report is attached to the staff report as Appendix D.

Rule Consistency Analysis

Pursuant to CH&SC Section 40727.2, prior to adopting, amending, or repealing a rule or regulation, the District is required to perform a written analysis that identifies and compares the air pollution control elements of the rule or regulation with corresponding elements of existing or proposed District and EPA rules, regulations, and guidelines that apply to the same source category. District staff has concluded that the proposed rules are not in conflict with nor inconsistent with other District rules, nor are the proposed rules in conflict with nor inconsistent with federal policy, rule, or regulations governing the same source category. The analysis is discussed further in Appendix E of the staff report.

Environmental Impacts

There are no other actions or rule requirements associated with this project. Based on the District's review, substantial evidence supports the District's conclusion that the amendments will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and as such is not a "project" as that term is defined under the California Environmental Quality Act (CEQA) Guidelines § 15378. In addition, substantial evidence supports the District's conclusion that, if one assumes the amendment is a "project" under CEQA in spite of our conclusion to the contrary, it will not have any significant adverse effects on the environment.

Reasonably Available Control Technology (RACT) and Best Available Retrofit Control Technology (BARCT) Analyses

Sections 182(b)(2) and 182(f) of the federal Clean Air Act require ozone nonattainment areas to implement RACT for sources that are subject to Control Techniques Guidelines

(CTG) documents issued by EPA and for "major sources" of VOCs and NOx, which are ozone precursors. RACT can be defined as devices, systems, process modifications, or other apparatus or techniques that are reasonably available, taking into account the necessity of imposing such controls in order to attain and maintain a NAAQS, the social, environmental, and economic impact of such controls; and alternative means of providing for attainment and maintenance of such a standard.

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617), Non-vehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. One requirement of AB 617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements. Most existing stationary sources in non-attainment areas such as the San Joaquin Valley have been subject to Best Available Retrofit Control Technology (BARCT) requirements since the 1980s. California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

"Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source."

Appendix F of the staff report evaluates the requirements of Proposed Rule 4702 in light of the previous definitions of RACT and BARCT. Based on the District's review, the proposed requirements in Rule 4702 would meet or exceed state and federal requirements for RACT and BARCT.

Rule Development Public Process

District staff conducted a public Scoping Meeting on December 5, 2019 and public workshops in September 2020, November 2020, and June 2021. Updates were also presented throughout the rulemaking process at multiple public meetings of the Citizens Advisory Committee, Environmental Justice Advisory Group, and the District Governing Board. At the public workshops, District staff presented the objectives of the proposed rulemaking project. Initial draft amendments to Rule 4702 were published for public review on December 9, 2020, and an updated draft was published on June 28, 2021. Throughout the rule development process, District staff solicited information from affected source operators, consultants, vendors and manufacturers of control technologies, and trade associations on the technological feasibility and compliance cost information that would be useful in developing amendments to Rule 4702. The comments received from the public, affected sources, and interested parties during the public outreach and workshop process were incorporated into the rule or addressed in the staff report as appropriate.

The proposed rule amendments and draft staff report with associated appendices were published for 30-day public review and comment prior to the public hearing to consider

the adoption of the proposed amendments to Rule 4702 by the District Governing Board. A summary of significant comments and District responses is available in Appendix A of the final draft staff report.

FISCAL IMPACT:

District staff expects no fiscal impact to result from this action.

Attachments:

Attachment A: Resolution for Proposed Amendments to Rule 4702 (5 pages)
Attachment B: Proposed Amendments to Rule 4702 (40 pages)
Attachment C: Final Draft Staff Report for Proposed Amendments to Rule 4702 (131 pages)

San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
August 19, 2021

ADOPT PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES)

Attachment A:

Resolution for Proposed Amendments to Rule 4702

(5 PAGES)

BEFORE THE GOVERNING BOARD OF THE SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

IN THE MATTER OF: PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES)) **RESOLUTION NO. _____**

WHEREAS, the San Joaquin Valley Unified Air Pollution Control District (District) is a duly constituted unified air pollution control district, as provided in California Health and Safety Code (CH&SC) Sections (§) 40150 et seq. and 40600 et seq.; and

WHEREAS, said District is authorized by CH&SC §40702 to make and enforce all necessary and proper orders, rules, and regulations to accomplish the purpose of Division 26 of the CH&SC; and

WHEREAS, pursuant to federal Clean Air Act (CAA) §107, the San Joaquin Valley Air Basin (Valley) is designated as nonattainment for the national health-based air quality standards for ozone and particulate matter 2.5 microns and smaller (PM2.5); and

WHEREAS, the District Governing Board adopted 2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards (*2018 PM2.5 Plan*) on November 15, 2018 pursuant to the federal Clean Air Act; and

WHEREAS, the District's *2018 PM2.5 Plan* commits the District to amend Rule 4702 (Internal Combustion Engines) to further reduce NOx and VOC emissions from this source category; and

WHEREAS, Sections 182(b)(2) and 182(f) of the federal Clean Air Act (CAA) require areas that are classified as moderate or above for ozone nonattainment to implement Reasonably Available Control Technology (RACT) for sources subject to U.S. Environmental Protection Agency (EPA) Control Techniques Guidelines (CTG) or for "major sources" of NOx and volatile organic compounds (VOC); and

WHEREAS, pursuant to California Assembly Bill 617 (AB 617), Rule 4702 is subject to Best Available Retrofit Control Technology (BARCT) requirements in conjunction with

PM2.5 Plan commitments; and

WHEREAS, the staff report and other supporting documentation was presented to the District Governing Board and the Board has reviewed and considered the entirety of this information prior to approving the project; and

WHEREAS, District staff conducted public workshops regarding Proposed Rule 4702 on September 24, 2020, November 18, 2020; and June 28, 2021; and

WHEREAS, a public hearing for the adoption of proposed amendments to Rule 4702 was duly noticed for August 19, 2021 in accordance with CH&SC §40725.

NOW, THEREFORE, BE IT RESOLVED AS FOLLOWS:

1. The Governing Board hereby adopts the proposed amendments to Rule 4702 (Internal Combustion Engines). Said rule shall become effective on August 19, 2021.

2. The Governing Board hereby finds, based on the evidence and information presented at the hearing upon which its decision is based, that all notices required to be given by law have been duly given in accordance with CH&SC §40725, and the Governing Board has allowed public testimony in accordance with CH&SC §40726.

3. In connection with said rulemaking, the Governing Board makes the following findings as required by CH&SC §40727:

a. **NECESSITY.** The Governing Board finds, based on the staff report, public testimony, and the record for this rulemaking proceeding, that a need exists for said rule amendments. Amending Rule 4702 is necessary to meet the commitments of the SIP and requirements of the federal CAA and the California CAA. Said Rule amendments satisfy the commitment in the District's *2018 PM2.5 Plan*.

b. **AUTHORITY.** The Governing Board finds that it has the legal authority for said rulemaking under CH&SC §40000 and 40001.

c. **CLARITY.** The Governing Board finds that the Rule amendment is written or displayed so that the meaning can be easily understood by those persons or industries directly affected by the Rule.

d. **CONSISTENCY.** The Governing Board finds that the Rule is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

e. **NONDUPLICATION.** The Governing Board finds that the Rule does not impose the same requirements as any existing state or federal regulation.

f. **REFERENCE.** The Governing Board finds that said rulemaking implements federal CAA §172(c)(1) and CH&SC §40920.

4. The Governing Board hereby finds that the requirements of CH&SC §40728.5 and §40920.6 have been satisfied to the greatest extent possible, and that the Governing Board has actively considered and made a good faith effort to minimize any adverse socioeconomic impacts associated with the proposed rulemaking.

5. The Governing Board finds that, because this rulemaking will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, the proposed actions do not constitute a project under the provisions of the California Environmental Quality Act (CEQA) Guidelines §15378. Furthermore, the proposed actions are exempt for actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment (CEQA Guidelines §15308) (Actions by Regulatory Agencies for Protection of the Environment) and exempt from CEQA per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061 (b)(3)).

6. Pursuant to Section 15062 of the CEQA guidelines, the Executive Director/Air Pollution Control Officer is directed to file a Notice of Exemption with the County Clerks of each of the counties in the District.

7. The Executive Director/Air Pollution Control Officer is directed to file with all appropriate agencies certified copies of this resolution and the rule adopted herein and

is directed to maintain a record of this rulemaking proceeding in accordance with CH&SC §40728.

8. The Executive Director/Air Pollution Control Officer is directed to transmit said rule to the California Air Resources Board for incorporation into the SIP.

9. The Governing Board authorizes the Executive Director/Air Pollution Control Officer to include in the submittal or subsequent documentation any technical corrections, clarifications, or additions that may be needed to secure EPA approval, provided such changes do not alter the substantive requirements of the approved rule.,

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THE FOREGOING was passed and adopted by the following vote of the Governing Board of the San Joaquin Valley Unified Air Pollution Control District this 19th day of August 2021, to wit:

AYES:

NOES:

ABSENT:

SAN JOAQUIN VALLEY UNIFIED
AIR POLLUTION CONTROL DISTRICT

By _____
Craig Pedersen, Chair
Governing Board

ATTEST:
Deputy Clerk of the Governing Board

By _____
Michelle Franco

SJVUAPCD
1990 E. Gettysburg Ave.
Fresno, CA 93726
(559) 230-6000

San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
August 19, 2021

ADOPT PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES)

Attachment B:

Proposed Amendments to Rule 4702

(40 PAGES)

RULE 4702 INTERNAL COMBUSTION ENGINES (Adopted August 21, 2003; Amended June 16, 2005; Amended April 20, 2006; Amended January 18, 2007; Amended August 18, 2011; Amended November 14, 2013; Amended date)

1.0 Purpose

The purpose of this rule is to limit the emissions of nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter (PM), and sulfur oxides (SOx) from internal combustion engines.

2.0 Applicability

This rule applies to any internal combustion engine rated at 25 brake horsepower or greater.

3.0 Definitions

3.1 Agriculture Operations (AO): the growing and harvesting of crops or the raising of fowl or animals, for the primary purpose of earning a living, or of conducting agricultural research or instruction by an educational institution.

3.2 Air Pollution Control Officer (APCO): the Air Pollution Control Officer of the San Joaquin Valley Unified Air Pollution Control District, or any person authorized to act on behalf of the APCO.

3.3 ARB: California Air Resources Board.

3.4 California Reformulated Diesel: diesel fuel meeting 15 ppmv sulfur content limit as required by the California Diesel Fuel Regulations as specified in the California Code of Regulations, Title 13, Division 3, Chapter 5 (Standards for Motor Vehicle Fuels), Article 2 (Standards for Diesel Fuel), Section 2281- Sulfur content of Diesel Fuel.

3.5 California Reformulated Gasoline: gasoline meeting ARB requirements for motor vehicle fuel as specified in California Code of Regulations, Title 13, Division 3, Chapter 5, Article 1, Subarticle 2 - Standards for gasoline sold beginning March 1, 1996.

3.6 Certified Compression-Ignited Engine: a Tier 1, Tier 2, Tier 3, or Tier 4 compression-ignited engine that is EPA certified as specified in Title 40 Code of Federal Regulations Part 89 or in Title 40 Code of Federal Regulations Part 1039.

3.7 Certified Spark-Ignited Engine: a spark-ignited engine that is used exclusively in agricultural operations and that is ARB certified as specified in Title 13, Division 3, Chapter 9, Article 4.5, Section 2433 of the California Code of Regulations or has an EPA certification per 40 CFR Part 1048 and that has been certified to meet a Certification Level at or below the NOx emission limits in Table 5~~for hydrocarbon plus NOx emissions of 0.6 grams/bhp-hr (40.2 ppmv) or less~~.

3.8 CO: carbon monoxide.

3.9 Compression-Ignited Internal Combustion Engine: an engine that uses the heat of compression to initiate combustion.

3.10 Cyclic Loaded Engine: an internal combustion engine that, under normal operating conditions, varies in shaft load by 40% or more of rated brake horsepower during recurrent periods of 30 seconds or less or is used to power an oil well reciprocating pump unit.

3.11 De-rated Engine: an internal combustion engine which has been physically limited and restricted by permit condition to an operational level of less than 50 horsepower.

3.12 Diesel Engine: a compression-ignited internal combustion engine.

3.13 Disaster or State of Emergency: a fire, flood, earthquake, or other similar natural catastrophe.

3.14 Distributed Generation (DG): relatively small power plants, such as internal combustion engine generator sets, which are used to generate electrical power that is either fed into the power grid or used on-site. DG units are located throughout the grid and are usually sited in or close to load centers or utility customers' sites. Distributed Generation also refers to a mechanical drive system consisting of one or more internal combustion engines and electric motors, where use of the internal combustion engines or electric motors is interchangeable.

3.15 Emergency Standby Engine: an internal combustion engine which operates as a temporary replacement for primary mechanical or electrical power during an unscheduled outage caused by sudden and reasonably unforeseen natural disasters or sudden and reasonably unforeseen events beyond the control of the operator. An engine shall be considered to be an emergency standby engine if it is used only for the following purposes: (1) periodic maintenance, periodic readiness testing, or readiness testing during and after repair work; (2) unscheduled outages, or to supply power while maintenance is performed or repairs are made to the primary power supply; and (3) if it is limited to operate 100 hours or less per calendar year for non-emergency purposes. An engine shall not be considered to be an emergency standby engine if it is used: (1) to reduce the demand for electrical power when normal electrical power line service has not failed, or (2) to produce power for the utility electrical distribution system, or (3) in conjunction with a voluntary utility demand reduction program or interruptible power contract.

3.16 EPA: U.S. Environmental Protection Agency.

3.17 Exhaust Control: device or technique used to treat an engine's exhaust to reduce NOx, VOC, or CO emissions, and includes, but is not limited to, catalysts, afterburners, reaction chambers, and chemical injectors.

3.18 Flood: a sudden and reasonably unforeseen rising and overflowing of a body of water especially onto normally dry land.

3.19 Gaseous Fuel: a fuel which is a gas at standard conditions including but not limited to natural gas, methane, ethane, propane, butane and liquefied petroleum gas (LPG).

3.20 Higher Heating Value (hhv): the total heat liberated per mass or volume of fuel burned (expressed as Btu per pound, Btu per cubic foot, or Btu per gallon), when fuel and dry air at Standard Conditions undergo complete combustion and all resulting products are brought to their standard states at Standard Conditions. If certification of hhv is not provided by the fuel supplier, it shall be determined by the applicable test methods specified in Section 6.4.

3.21 Installation Date: the date that an internal combustion engine is initially placed at a location in order to be operated for the first time in its lifetime.

3.22 Internal Combustion Engine: a spark- or compression-ignited reciprocating engine.

3.23 Lean-Burn Engine: a spark-ignited internal combustion engine that is operated with an exhaust stream oxygen concentration of four (4) percent by volume, or greater, prior to any exhaust stream control device.

3.24 Limited Use Engine: an internal combustion engine that is limited by a permit condition to be operated no more than 4,000 hours per calendar year and provided the following requirements are met:

3.24.1 The engine is operated with an operating nonresettable elapsed time meter;

3.24.2 In lieu of an operating nonresettable elapsed time meter, the operator may use an alternative device, method, or technique, in determining operating time, provided that the alternative is approved by the APCO and EPA and is allowed by the Permit-to-Operate. The operator must demonstrate that the alternative device, method, or technique is equivalent to using a nonresettable elapsed time meter;

3.24.3 The operator shall properly maintain and operate the nonresettable elapsed time meter or alternative device in accordance with the manufacturer's instructions; and

3.24.4 The engine operator maintains records of the annual operating hours and makes the records available to the APCO upon request.

3.25 Location: a single site at a building, structure, facility, or installation.

3.26 Low-use Engine: an internal combustion engine that is limited by a permit condition to be operated no more than 200 hours per calendar year and the engine is not used to perform any of the functions specified in Section 3.26.1 through Section 3.26.3.

3.26.1 Generate electrical power that is either fed into the electrical utility power grid or used to reduce electrical power purchased by a stationary source;

3.26.2 Generate mechanical power that is used to reduce electrical power purchased by a stationary source; or

3.26.3 Is used in a distributed generation application.

3.27 Military Tactical Equipment: a transportable engine operated by the United States armed forces or National Guard which is designed specifically for military use in an off-road, dense terrain; hostile environment; or aboard military combat vessels.

3.28 Mobile Agricultural Equipment: equipment at an agricultural operation which is towed or mounted on a vehicle and is continuously moved during the operation of the equipment. Mobile Agricultural Equipment includes, but is not limited to sprayers, balers, and harvest equipment.

3.29 NOx: oxides of nitrogen, calculated as equivalent nitrogen dioxide (NO_2).

3.30 Operator: includes but is not limited to any person who owns, leases, supervises, or operates a facility and/or equipment.

3.31 Particulate Matter: any material except uncombined water, which exists in a finely divided form as a liquid or solid at standard conditions.

3.3~~1~~2 Public Utilities Commission (PUC) Quality Natural Gas: high methane gas (at least 80% methane by volume) as specified in PUC General Order 58-A.

3.3~~2~~3 Rated Brake Horsepower: the continuous brake horsepower rating specified for the engine by the manufacturer or listed on the nameplate of the unit, unless otherwise physically limited and specified by a condition on the engine's Permit-to-Operate or Permit-Exempt Equipment Registration.

3.3~~3~~4 Replacement Unit ~~Engine~~: an engine that is installed to replace an engine that was in place as of August 18, 2011, and that such replacement is performed solely for the purpose of complying with the requirements of Section 5.2 of this rule.

3.3~~4~~5 Rich-Burn Engine: a spark-ignited internal combustion engine that is operated with an exhaust stream oxygen concentration of less than four (4) percent by volume prior to any exhaust stream control device.

3.3~~5~~6 Spark-Ignited Internal Combustion Engine: a liquid or gaseous fueled engine designed to ignite its air/fuel mixture by a spark across a spark plug.

3.3~~6~~7 Stationary Source: as defined in Rule 2201 (New and Modified Stationary Source Review Rule).

3.3~~7~~8 Tier 1 Engine, Tier 2 Engine, Tier 3 Engine, and Tier 4 Engine: an EPA-certified compression-ignited engine that meets the Tier 1, Tier 2, or Tier 3 emission standards of Table 1 (Emission Standards in g/kW-hr (g/hp-hr)) on page 56970 of the Final Rule (63 Fed. Reg. 205, October 23, 1998) or the Tier 4 emission standards of Table II.A2. (Tier 4 NOx and NMHC Standards and Schedule) on page 38971 of the Final Rule (69 Fed. Reg. 124, June 29, 2004) or Table II.A-4 (Tier 4 Standards for Engines Over 750 hp (g/bhp-hr)) on page 38980 of the Final Rule (69 Fed. Reg. 124, June 29, 2004), respectively.

3.3~~8~~9 VOC: volatile organic compounds, as defined in Rule 1020 (Definitions).

3.~~39~~40 Waste Gas: an untreated, raw gas derived through a natural process, such as anaerobic digestion, from the decomposition of organic waste at municipal solid waste landfills or publicly owned wastewater treatment facility. Waste gas includes landfill gas which is generated at landfills, digester gas which is generated at sewage treatment facilities, or a combination of the two.

3.4~~0~~1 Wind Machine: a machine consisting of a large fan mounted on a tower powered by an internal combustion engine, used exclusively to provide protection to crops, including, but not limited to oranges, lemons, and grapes, from cold weather by effecting a heat transfer by moving warmer atmospheric air downward and mixing it with the colder air surrounding a crop.

4.0 Exemptions

4.1 The requirements of this rule shall not apply to the following engines:

4.1.1 An engine used to propel implements of husbandry, as that term is defined in Section 36000 of the California Vehicle Code, as that section existed on January 1, 2003.

4.1.2 An engine used exclusively to power a wind machine.

4.1.3 A de-rated spark-ignited engine not used in agricultural operations, provided the de-rating occurred before June 1, 2004.

4.1.4 A de-rated spark-ignited engine used in agricultural operations or a de-rated compression-ignited engine, provided the de-rating occurred before June 1, 2005.

4.1.5 An engine used exclusively to power Mobile Agricultural Equipment.

4.1.6 An internal combustion engine registered as a portable emissions unit under the Statewide Portable Equipment Registration Program pursuant to California Code of Regulations Title 13, Division 3, Chapter 9, Article 5, Sections 2450-2465.

4.1.7 An internal combustion engine registered as a portable emissions unit under Rule 2280 (Portable Equipment Registration).

4.2 Except for the requirements of Sections 5.9 and 6.2.3, the requirements of this rule shall not apply to an emergency standby engine or a low-use engine, provided that the engine is operated with a functional nonresettable elapsed time meter.

4.2.1 In lieu of operating a nonresettable elapsed time meter, the operator may use an alternative device, method, or technique, in determining operating time, provided that the alternative is approved by the APCO and EPA and is allowed by the Permit-to-Operate or Permit-Exempt Equipment Registration. The operator must demonstrate that the alternative device, method, or technique is equivalent to using a nonresettable elapsed time meter.

4.2.2 The operator shall properly maintain and operate the nonresettable elapsed time meter or alternative device in accordance with the manufacturer's instructions.

4.3 Except for the administrative requirements of Section 6.2.3, the requirements of this rule shall not apply to the following:

4.3.1 An internal combustion engine that meets the following conditions:

4.3.1.1 The engine is operated exclusively to preserve or protect property, human life, or public health during a disaster or state of emergency, such as a fire or flood; and

4.3.1.2 Except for operations associated with Section 4.3.1.1, the engine is limited to operate no more than 100 hours per calendar year as determined by an operational nonresettable elapsed time meter, for periodic maintenance, periodic readiness testing, and readiness testing during and after repair work of the engine; and

4.3.1.3 The engine is operated with an operational nonresettable elapsed time meter. In lieu of installing a nonresettable elapsed time meter, the operator of an engine may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO and EPA. The operator of the engine shall properly maintain and operate the nonresettable elapsed time meter or alternative device in accordance with the manufacturer's instructions.

4.3.2 Military Tactical Equipment and engines used to retract military aircraft arresting gear cables.

4.4 For existing facilities, a replacement unit installed for the sole purpose of complying with the requirements of this rule shall be considered to be an emission control technique and shall be exempt from the Best Available Control Technology (BACT) and offsets requirements of District Rule 2201 (New and Modified Stationary Source Review Rule) provided that all other requirements of Rule 2201 are met.

4.5 Except for the requirements of Section 5.1, the requirements of this rule shall not apply to stationary engines rated at least 25 Brake Horsepower, up to, and including 50 Brake Horsepower.

5.0 Requirements

5.1 Stationary Engines Rated at Least 25 Brake Horsepower, Up To, and Including 50 Brake Horsepower and Used in Non-Agricultural Operations (Non-AO)

5.1.1 ~~On and after July 1, 2012~~ No person shall sell or offer for sale any non-AO spark-ignited engine or any non-AO compression-ignited engine unless the engine meets the applicable requirements and emission limits specified in 40 Code of Federal Regulation (CFR) 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines) and 40 CFR 60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines) for the year in which the ownership of the engine changes.

~~5.1.2 By January 1, 2013, the operator shall submit a one-time report that includes the number of engines at the stationary source, and the following information for each engine:~~

~~5.1.2.1 Location of each engine,~~
~~5.1.2.2 Engine manufacturer,~~
~~5.1.2.3 Model designation and engine serial number,~~
~~5.1.2.4 Rated brake horsepower,~~
~~5.1.2.5 Type of fuel and type of ignition,~~
~~5.1.2.6 Combustion type: rich-burn, lean-burn, or compression ignition,~~
~~5.1.2.7 Purpose, and intended use, of the engine,~~
~~5.1.2.8 Typical daily operating schedule, and~~
~~5.1.2.9 Fuel consumption (cubic feet for gas or gallons for liquid fuel) for the previous one-year period.~~

5.2 Engines Rated at Greater than 50 Brake Horsepower (>50 bhp)

5.2.1 Spark Ignited Engines Used in non-AO - Table 1 Emission Limits/Standards

The operator of a spark-ignited internal combustion engine rated at >50 bhp that is used exclusively in non-AO shall not operate it in such a manner that results in emissions exceeding the limits in Table 1 for the appropriate engine type until such time that the engine has demonstrated compliance with Table 2 emission limits pursuant to the compliance deadlines in Section 7.5. In lieu of complying with Table 1 emission limits, the operator of a spark-ignited engine shall comply with the applicable emission limits pursuant to Section 8.0.

Table 1 Emission Limits/Standards for a Spark-Ignited Internal Combustion Engine rated at >50 bhp Used Exclusively in Non-AO (All ppmv limits are corrected to 15% oxygen on a dry basis.).			
Engine Type	NOx	CO	VOC
1. Rich-Burn			
a. Waste gas fueled (≥ 50% total heat monthly input from waste gas based on hhv)	90% reduction	2000 ppmv	250 ppmv
b. Cyclic loaded, field gas fueled	50 ppmv	2000 ppmv	250 ppmv
d. All other engines	25 ppmv or 96% reduction	2000 ppmv	250 ppmv
2. Lean-Burn			
a. Two stroke, gaseous fueled, less than 100 horsepower	75 ppmv or 85% reduction	2000 ppmv	750 ppmv
e. All other engines	65 ppmv or 90% reduction	2000 ppmv	750 ppmv

5.2.2 Spark-Ignited Engines Used in non-AO – Table 2 and 3 Emission Limits/Standards

On and after the compliance schedule specified in Section 7.5, the operator of a spark-ignited engine > 50 bhp that is used in non-AO shall comply with all the applicable requirements of the rule and one of the following, on an engine-by-engine basis:

5.2.2.1 On and after the compliance schedule specified in Section 7.5, the operator of a spark-ignited engine that is used exclusively in non-AO shall comply with Sections 5.2.2.1.1 through 5.2.2.1.3 on an engine-by-engine basis:

5.2.2.1.1 NOx, CO, and VOC emission limits pursuant to Table 2 or Table 3, as applicable;

5.2.2.1.2 SOx control requirements of Section 5.7, pursuant to the deadlines specified in Section 7.5; and

5.2.2.1.3 Monitoring requirements of Section 5.~~10~~11, pursuant to the deadlines specified in Section 7.5.

5.2.2.2 In lieu of complying with the NOx emission limit requirement of Section 5.2.2.1.1, an operator may pay an annual fee to the District, as specified in Section 5.6, pursuant to Section 7.6. This compliance option will sunset after December 31, 2023, where after an operator must comply with the NOx emissions limit requirements in Table 2 and Table 3, per the compliance schedule included in Section 7.5.

5.2.2.2.1 Engines in the fee payment program shall have actual emissions not greater than the applicable limits in Table 1 during the entire time the engine is part of the fee payment program.

~~5.2.2.2.2 Compliance with Section 5.7 and 5.1011, pursuant to the deadlines specified in Section 7.5, is also required as part of the fee payment option.~~

5.2.2.3 In lieu of complying with the NOx, CO, and VOC limits of Table 2 or Table 3 on an engine-by-engine basis, an operator may elect to implement an alternative emission control plan pursuant to Section 8.0. An operator electing this option shall not be eligible to participate in the fee payment option outlined in Section 5.2.2.2 and Section 5.6.

Table 2 Emission Limits for a Spark-Ignited Internal Combustion Engine Rated at >50 bhp Used Exclusively in Non-AO (All ppmv limits are corrected to 15% oxygen on a dry basis). Emission Limits are effective according to the compliance schedule specified in Section 7.5, Table 7.

Engine Type	NOx Limit (ppmv)	CO Limit (ppmv)	VOC Limit (ppmv)
1. Rich-Burn			
a. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	50	2000	250
b. Cyclic Loaded, Field Gas Fueled	50	2000	250
c. Limited Use	25	2000	250
d. Rich-Burn Engine, not listed above	11	2000	250
2. Lean-Burn Engines			
a. Two-Stroke, Gaseous Fueled, >50 bhp and < 100 bhp	75	2000	750
b. Limited Use	65	2000	750
c. Lean-Burn Engine used for gas compression	65 ppmv or 93% reduction	2000	750
d. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	65 ppmv or 90% reduction	2000	750
e. Lean-Burn Engine, not listed above	11	2000	750

Table 3 Emission Limits for a Spark-Ignited Internal Combustion Engine Rated at >50 bhp Used Exclusively in Non-AO (All ppmv limits are corrected to 15% oxygen on a dry basis). Emission Limits are effective according to the compliance schedule specified in Section 7.5, Table 8.

Engine Type	NOx Limit (ppmv)	CO Limit (ppmv)	VOC Limit (ppmv)
1. Rich-Burn			
a. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	11	2000	90
b. Cyclic Loaded, Field Gas Fueled	11	2000	90
c. Limited Use	11	2000	90
d. Rich-Burn Engine, not listed above	11	2000	90
2. Lean-Burn Engines			
a. Limited Use	11	2000	90
b Lean-Burn Engine used for gas compression	40	2000	90
c. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	40	2000	90
d. Lean-Burn Engine, not listed above	11	2000	90

5.2.3 Spark-Ignited Engines Used Exclusively in Agricultural Operations (AO)

5.2.3.1 The operator of a spark-ignited internal combustion engine rated at >50 bhp that is used exclusively in AO shall not operate it in such a manner that results in emissions exceeding the limits in Table 4 ~~3~~ for the appropriate engine type on an engine-by-engine basis.

On and after the compliance schedule specified in Section 7.5 Table 9, the operator of a spark-ignited internal combustion engine rated at >50 bhp that is used exclusively in AO shall comply with the emission limits specified in Table 5.

5.2.3.2 In lieu of complying with the NOx, CO, and VOC limits of Table ~~4~~3 or 5 on an engine-by-engine basis, an operator may elect to implement an alternative emission control plan pursuant to Section 8.0.

5.2.3.3 An operator of an AO spark-ignited engine that is subject to the applicable requirements of Table ~~4~~3 or 5 shall not replace such engine with an engine that emits more emissions of NOx, VOC, and CO, on a ppmv basis, (corrected to 15% oxygen on a dry basis) than the engine being replaced.

Table 43 Emission Limits/Standards ~~and Compliance Schedule~~ for a Spark-Ignited Internal Combustion Engine >50 bhp Used Exclusively in AO (All ppmv limits are corrected to 15% oxygen on a dry basis).			
Engine Type	NOx Limit	CO Limit	VOC Limit
1. Rich-Burn	90 ppmv or 80% reduction	2000 ppmv	250 ppmv
2. Lean-Burn	150 ppmv or 70% reduction	2000 ppmv	750 ppmv
3. Certified and installed on or before June 16, 2005	Meet a Certified Spark-Ignited Engine Standard of HC + NOx < 0.6 g/bhp-hr		

Table 5 Emission Limits/Standards for a Spark-Ignited Internal Combustion Engine >50 bhp Used Exclusively in AO (All ppmv limits are corrected to 15% oxygen on a dry basis). Emission Limits are effective according to the compliance schedule specified in Section 7.5, Table 9.			
Engine Type	NOx Limit	CO Limit	VOC Limit
1. Rich-Burn	0.15 g/bhp-hr or 11 ppmv	2000 ppmv	90 ppmv
2. Lean-Burn	0.6 g/bhp-hr or 43 ppmv	2000 ppmv	90 ppmv

5.2.4 Certified Compression-Ignited Engines (AO and non-AO)

The operator of a certified compression-ignited engine rated >50 bhp shall comply with the following requirements:

5.2.4.1 Repower, replace, or control the engine's emissions to comply with the applicable limits/standards in Table 46 on an engine-by-engine basis by the compliance dates as specified in Table ~~4~~6.

5.2.4.2 The annual hours of operation shall be determined on a calendar year basis.

5.2.4.3 In lieu of complying with the ~~NOx, CO, and VOC limits~~ emission standards of Table ~~4~~6 on an engine-by-engine basis, an operator may elect to implement an alternative emission control plan pursuant to Section 8.0.

5.2.4.4 An operator of an AO compression-ignited engine that is subject to the applicable requirements of Table ~~4~~ 6 shall not replace such engine with an engine that emits more emissions of NOx, VOC, and CO, on a ppmv basis, (corrected to 15% oxygen on a dry basis) than the engine being replaced.

5.2.4.5 ~~Non-AO~~ Compression-ignited engines shall be operated in such a manner to comply with the SOx control requirements of Section

5.7, and the SOx monitoring requirements of Section 5.~~10~~11, per the compliance dates in Table 6 below for the applicable engine type.

Table ~~6~~4 Emission Standards and Compliance Schedule for Compression-Ignited Internal Combustion Engine		
Engine Type	Emission Standard	Compliance Date
1. Non-Certified Compression-Ignited Engine Installed on or before January 1, 2015		
a. Greater than 50 bhp but not more than 500 bhp	EPA Tier 3 or Tier 4	1/1/2010
b. Greater than 500 bhp but not more than 750 bhp and less than 1000 annual operating hours	EPA Tier 3	1/1/2010
c. Greater than 750 bhp and less than 1000 annual operating hours	EPA Tier 4	7/1/2011
~~d. Greater than 500 bhp and greater than or equal to 1000 annual operating hours~~	~~80 ppmv NOx, 2,000 ppmv CO, 750 ppmv VOC~~	~~1/1/2008, if owner has an agreement to electrify, comply by 1/1/2010~~
2. Certified Compression-Ignited Engine		
a. EPA Certified Tier 1 or Tier 2 Engine	EPA Tier 4	1/1/2015 or 12 years after installation date, but not later than 6/1/2018
b. EPA Certified Tier 3 or Tier 4 Engine	Meet Certified Compression-Ignited Engine Standard in effect at time of installation	At time of installation

5.2.5 Non-Certified Compression-Ignited Engines (AO and Non-AO)

The operator of a non-certified compression-ignited engine, in place on or before June 1, 2006, shall comply with the Emission Standard and Compliance Date in Table ~~4~~6 based on the non-certified compression-ignited engine that was in place on June 1, 2006, unless the operator meets one of the following conditions:

5.2.5.1 Replace the non-certified compression-ignited engine with a non-modified Tier 3 or a non-modified Tier 4 engine after June 1, 2006;

5.3 All continuous emission monitoring systems (CEMS) emissions measurements shall be averaged over a period of 15 consecutive minutes. Any 15-consecutive-minute block average CEMS measurement exceeding the applicable emission limits of this rule shall constitute a violation of this rule.

5.4 Percent emission reductions, if used to comply with the NOx emission limits of Section 5.2, shall be calculated as follows:

5.4.1 For engines with external control devices that are not operated in combination with a second emission control device or technique, percent reduction shall be calculated using emission samples taken at the inlet and outlet of the control device.

5.4.2 For engines without external control devices and for engines with an external control device in combination with a second emission control device or technique, percent reduction shall be based on source test results for the uncontrolled engine and the engine after the control device or technique has been employed. In this situation, the engine's typical operating parameters, loading, and duty cycle shall be documented and repeated at each successive post-control source test to ensure that the engine is meeting the percent reduction limit. When representative source sampling prior to the application of an emissions control technology or technique is not available, the APCO may approve the use of a manufacturer's uncontrolled emissions information or source sampling from a similar, uncontrolled engine.

5.5 The operator of an internal combustion engine that uses percent emission reduction to comply with the NOx emission limits of Section 5.2 shall provide an accessible inlet and outlet on the external control device or the engine as appropriate for taking emission samples and as approved by the APCO.

5.6 Payment of an Annual Fee In Lieu of Complying with a NOx Emission Limit

The operator of a non-AO spark-ignited engine who elects to comply under Section 5.2.2.2 shall comply with the requirements of Sections 5.6 by the schedule specified in Section 7.6 and all other applicable provisions of this rule.

<u>The emissions fee compliance option provided under Section 5.2.2.2 shall sunset after December 31, 2023, where after an operator must comply with the NOx emissions limit requirements in Table 3, per the compliance schedule included in Section 7.5. The final emissions fee payment shall be due to the District no later than July 1, 2024.</u>

5.6.1 An operator shall pay a total annual fee to the District based on the total NOx emissions from those engines that will be subject to Section 5.2.2.2. The annual fee shall be calculated in the following manner:

5.6.1.1 The operator shall calculate the total emissions for all engines operating at a stationary source that will comply with Section 5.2.2.2. The total NOx emissions shall be calculated in accordance with Section 5.6.1.3.

5.6.1.2 The total annual fee shall be calculated in accordance with Section 5.6.1.4. These calculations include only the units that have been identified to comply with Section 5.2.2.2.

5.6.1.3 Total Emissions (TE) Calculation

$E_{(engine)} = A \times B \times C \times D \times 2.147 \times 10^{-16}$

Where:

$E_{(engine)}$ = Annual NOx emissions for each unit, in tons/year.

A = NOx emission limit for the Permit-to-Operate, in ppmvd corrected to 15% oxygen.

B = Annual fuel use (ft3/year)

C = Fuel higher heating value (Btu/ft3) for natural gas use 1,000 Btu/ft3

D = Fuel F-Factor at 60°F (~~Đ~~dscf/MMBtu) for natural gas use 8,579 ~~Đ~~dscf/MMBtu

$TE = \sum E(engine)$

Where:

$\sum E(engine)$ = Sum of all NOx emissions from all units in the annual fee program, in tons per year.

5.6.1.4 Total Annual Fee Calculation

Total Annual Fee = (TE x FR) + Administrative Fee

Where:

TE	=	Total Emissions, in tons per year, as calculated in Section 5.6.1.3.
FR (Fee Rate)	=	the cost of NOx reductions, in dollars per ton, as established by District Rule 9510. Under no circumstances shall the cost per ton of NOx reductions exceed the cost effectiveness threshold for the Carl Moyer Cost Effectiveness, as established by the applicable state law.
Administrative Fee	=	4% x (TE x FR)

5.7 Sulfur Oxides (SOx) Emission Control Requirements

On and after the compliance schedules specified in Section -7.0, operators of ~~non-AO~~ spark-ignited engines and ~~non-AO~~ compression-ignited engines shall comply with one of the following requirements:

5.7.1 Operate the engine exclusively on PUC-quality natural gas, commercial propane, butane, or liquefied petroleum gas, or a combination of such gases; or

5.7.2 Limit gaseous fuel sulfur content to no more than five (5) grains of total sulfur per one hundred (100) standard cubic feet; or

5.7.3 Use California Reformulated Gasoline for gasoline-fired spark-ignited engines; or

5.7.4 Use California Reformulated Diesel for compression-ignited engines; or

5.7.5 Operate the engine on liquid fuel that contains no more than 15 ppm sulfur, as determined by the test method specified in Section 6.4.6; or

5.7.6 Install and properly operate an emission control system that reduces SO_2 emissions by at least 95% by weight as determined by the test method specified in Section 6.4.6.

5.7.7 For AO IC engines fueled with digester gas installed before 12/31/2021, limit fuel sulfur content to no more than 250 ppmv. For AO IC engines fueled with digester gas installed on or after 12/31/2021, units must comply with Section 5.7.2 or 5.7.6, above.

5.8 Particulate Matter (PM) Emission Control Requirements

On and after the compliance schedule specified in Section 5.2.4 and 7.0, operators of engines subject to this rule shall limit emissions of particulate matter through compliance with the following requirements:

5.8.1 Spark-ignited engines shall comply with the requirements of Section 5.7.

5.8.2 Compression-ignited engines shall comply with the applicable CARB/EPA Tier certification standard per Table 6.

5.~~8~~ 9 Monitoring Requirements: Non-AO Spark-Ignited Engines and Engines in an AECP (Section 8.0)

The operator of a non-AO spark-ignited engine subject to the requirements of Section 5.2 or any engine subject to the requirements of Section 8.0 shall comply with the following requirements:

5.~~8~~9.1 For each engine with a rated brake horsepower of 1,000 bhp or greater and which is allowed by Permit-to-Operate or Permit-Exempt Equipment Registration condition to operate more than 2,000 hours per calendar year, or with an external emission control device, either install, operate, and maintain continuous monitoring equipment for NOx, CO, and oxygen, as identified in Rule 1080 (Stack Monitoring), or install, operate, and maintain APCO-approved alternate monitoring. The monitoring system may be a continuous emissions monitoring system (CEMS), a parametric emissions monitoring system (PEMS), or an alternative monitoring system approved by the APCO. APCO-approved alternate monitoring shall consist of one or more of the following:

5.~~8~~9.1.1 Periodic NOx and CO emission concentrations,
5.~~8~~9.1.2 Engine exhaust oxygen concentration,
5.~~8~~9.1.3 Air-to-fuel ratio,
5.~~8~~9.1.4 Flow rate of reducing agents added to engine exhaust,
5.~~8~~9.1.5 Catalyst inlet and exhaust temperature,
5.~~8~~9.1.6 Catalyst inlet and exhaust oxygen concentration, or
5.~~8~~9.1.7 Other operational characteristics.

5.~~8~~9.2 For each engine not subject to Section 5.~~8~~9.1, monitor operational characteristics recommended by the engine manufacturer or emission control system supplier, and approved by the APCO.

5.~~8~~9.3 For each engine with an alternative monitoring system, submit to, and receive approval from the APCO, adequate verification of the alternative monitoring system's acceptability. This would include data demonstrating the system's accuracy under typical operating conditions for the specific

application and any other information or data deemed necessary in assessing the acceptability of the alternative monitoring system.

5.~~8~~9.4 For each engine with an APCO approved CEMS, operate the CEMS in compliance with the requirements of 40 Code of Federal Regulations (CFR) Part 51, 40 CFR Parts 60.7 and 60.13 (except subsection h), 40 CFR Appendix B (Performance Specifications), 40 CFR Appendix F (Quality Assurance Procedures), and applicable provisions of Rule 1080 (Stack Monitoring).

5.~~8~~9.5 For each engine, have the data gathering and retrieval capabilities of an installed monitoring system described in Section 5.~~8~~9 approved by the APCO.

5.~~8~~9.6 For each engine, install and operate a functional nonresettable elapsed time meter.

5.~~8~~9.6.1 In lieu of installing a nonresettable elapsed time meter, the operator may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO and EPA and is allowed by a Permit-to-Operate or Permit-Exempt Equipment Registration condition.

5.~~8~~9.6.2 The operator shall properly maintain and operate the nonresettable elapsed time meter or alternative device in accordance with the manufacturer's instructions.

5.~~8~~9.7 For each engine, implement the Inspection and Monitoring (I&M) plan, if any, submitted to and approved by the APCO pursuant to Section 6.5.

5.~~8~~9.8 For each engine, collect data through the I&M plan in a form approved by the APCO.

5.~~8~~9.9 For each engine, use a portable ~~NOx~~ analyzer to take NOx and CO emission readings and oxygen concentration readings to verify compliance with the emission requirements of Section 5.2 or Section 8.0 during each calendar quarter in which a source test is not performed and the engine is operated.

5.~~8~~9.9.1 If an engine is operated less than 120 calendar days per calendar year, take one NOx and CO emission reading and oxygen concentration reading during the calendar year in which a source test is not performed and the engine is operated.

5.~~8~~9.9.2 All emission readings shall be taken with the engine operating either at conditions representative of normal operations or conditions specified in the Permit-to-Operate or Permit-Exempt Equipment Registration.

5.~~8~~9.9.3 The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO.

5.~~8~~9.9.4 All NOx and CO emissions readings shall be reported to the APCO in a manner approved by the APCO.

5.~~8~~9.9.5 NOx and CO emission readings taken pursuant to this section shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings evenly spaced out over the 15 consecutive-minute period.

5.~~8~~9.10 The APCO shall not approve an alternative monitoring system unless it is documented that continued operation within ranges of specified emissions-related performance indicators or operational characteristics provides a reasonable assurance of compliance with applicable emission limits. The operator shall source test over the proposed range of surrogate operating parameters to demonstrate compliance with the applicable emission standards.

5.~~8~~9.11 For each engine subject to Section 8.0, install and operate a functional nonresettable fuel meter.

5.~~8~~9.11.1 In lieu of installing a nonresettable fuel meter, the operator may use an alternative device, method, or technique in determining daily fuel consumption provided that the alternative is approved by the APCO and EPA.

5.~~8~~9.11.2 The operator shall properly maintain, operate, and calibrate the required fuel meter in accordance with the manufacturer's instructions.

5.~~9~~10 Monitoring Requirements: All Other Engines

5.~~9~~10.1 The operator of any of the following engines shall comply with the requirements specified in Section 5.~~9~~10.2 through Section 5.~~9~~10.5 below:

5.~~9~~10.1.1 An AO spark-ignited engine subject to the requirements of Section 5.2;

5.~~9~~10.1.2 A compression-ignited engine subject to the requirements of Section 5.2; or

5.~~9~~10.1.3 An engine subject to Section 4.2.

5.~~9~~10.2 Properly operate and maintain each engine as recommended by the engine manufacturer or emission control system supplier.

5.~~9~~10.3 Monitor the operational characteristics of each engine as recommended by the engine manufacturer or emission control system supplier.

5.~~9~~10.4 Install and operate a functional nonresettable elapsed time meter.

5.~~9~~10.4.1 In lieu of installing a nonresettable elapsed time meter, the operator may use an alternative device, method, or technique, in determining operating time provided that the alternative is approved by the APCO and EPA and is allowed by a Permit-to-Operate or Permit-Exempt Equipment Registration condition.

5.~~9~~10.4.2 The operator shall properly maintain and operate the nonresettable elapsed time meter or alternative device in accordance with the manufacturer's instructions.

5.~~9~~10.5 ~~The operator of an AO spark-ignited engine that has been retro-fitted with a NOx exhaust control that has not been certified in accordance with Section 9.0 Exhaust Control System Certification Requirements, or a compression-ignited engine that has been retro-fitted with a NOx exhaust control shall comply with the following:~~

All AO spark-ignited engines and compression-ignited engines that have been retro-fitted with a NOx exhaust control, except certified spark-ignited engines, engines certified per Section 9.0, and certified compression-ignited engines, shall comply with Sections 5.10.5.1 through 5.10.5.7.

5.~~9~~10.5.1 Use a portable ~~NOx~~ analyzer to take NOx and CO emission readings and oxygen concentration readings to demonstrate compliance with the emission requirements of Section 5.2.

~~5.9.5.2 The operator of a compression-ignited engine that is subject to the limits/standards of Section 5.2 Table 4 Category 1.d shall use a portable NOx analyzer to take NOx emission readings at least once every six (6) months that the engine is operated.~~

5.~~9~~10.5.~~3~~2 The operator of any other engine that has been retro-fitted with a NOx exhaust control shall use a portable ~~NOx~~ analyzer to take NOx and CO emission readings and oxygen concentration readings at least once every 24 months that the engine is operated.

5.~~9~~10.5.~~4~~3 All emission readings shall be taken with the engine operating either at conditions representative of normal operations or conditions specified in the Permit-to-Operate or Permit-Exempt Equipment Registration.

5.~~9~~10.5.~~5~~4 The portable ~~NOx~~ analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO.

5.~~9~~10.5.~~6~~5 All NOx and CO emissions readings shall be reported to the APCO in a manner approved by the APCO.

5.~~9~~10.5.~~7~~6 NOx and CO emission readings taken pursuant to this section shall be averaged over a 15 consecutive-minute period by either taking a cumulative 15 consecutive-minute sample reading or by taking at least five (5) readings evenly spaced out over the 15 consecutive-minute period.

5.~~10~~11 SOx Emissions Monitoring Requirements

On and after the compliance schedules specified in Section 7.0, an operator of an ~~non-AO~~ engine shall comply with the following requirements:

5.~~10~~11.1 An operator of an engine complying with Sections 5.7.2, ~~or~~ 5.7.5, or Section 5.7.7 shall perform an annual fuel sulfur ~~fuel~~ analysis in accordance with the test methods in Section 6.4. The operator shall keep the records of the fuel analysis and shall provide it to the District upon request,

5.~~10~~11.2 An operator of an engine complying with Section 5.7.6 by installing and operating a control device with at least 95% by weight SOx reduction efficiency shall submit for approval by the APCO the proposed key system operating parameters and frequency of the monitoring and recording not later than July 1, 2013, and

5.~~10~~11.3 An operator of an engine complying with Section 5.7.6 shall perform an annual source test unless a more frequent sampling and reporting period is included in the Permit-to-Operate. Source tests shall be performed in accordance with the test methods in Section 6.4.

5.1~~1~~2 Permit-Exempt Equipment Registration Requirements

The operator of an engine used exclusively in agricultural operations shall register such engine pursuant to Rule 2250 (Permit-Exempt Equipment Registration), except for an engine that meets any one of the following conditions:

5.1~~1~~2.1 The engine is required to have a Permit-to-Operate pursuant to California Health and Safety Code Section 42301.16; or

5.112.2 The engine is not required to comply with Section 5.2 of this rule.

6.0 Administrative Requirements

6.1 Emission Control Plan

The operator of an engine subject to the requirements of Section 5.2 Table 3 Categories 1a, 1b, 1c, 2a, 2b, and 2c, and Table 5 of this rule shall submit to the APCO an APCO-approvable emission control plan of all actions to be taken to satisfy the emission requirements of Section 5.2 and the compliance schedules of Section 7.0. If there is no change to the previously-approved emission control plan, the operator shall submit a letter to the District indicating that the previously approved plan is still valid.

~~6.1.1 The requirement to submit an emission control plan shall apply to the following engines:~~

~~6.1.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;~~

~~6.1.1.2 Engines subject to Section 8.0;~~

~~6.1.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0;~~

~~6.1.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.~~

6.1.1~~2~~ Such emission control plan shall contain the following information, as applicable for each engine:

6.1.1~~2~~.1 Permit-to-Operate number, Authority-to-Construct number, or Permit-Exempt Equipment Registration number,
6.1.1~~2~~.2 Engine manufacturer,
6.1.1~~2~~.3 Model designation and engine serial number,
6.1.1~~2~~.4 Rated brake horsepower,
6.1.1~~2~~.5 Type of fuel and type of ignition,
6.1.1~~2~~.6 Combustion type: rich-burn or lean-burn,
6.1.1~~2~~.7 Total hours of operation in the previous one-year period, including typical daily operating schedule,
6.1.1~~2~~.8 Fuel consumption (cubic feet for gas or gallons for liquid) for the previous one-year period,
6.1.1~~2~~.9 Stack modifications to facilitate continuous in-stack monitoring and to facilitate source testing,
6.1.1~~2~~.10 Type of control to be applied, including in-stack monitoring specifications,
6.1.1~~2~~.11 Applicable emission limits,

6.1.1~~2~~.12 Documentation showing existing emissions of NOx, VOC, and CO, except for Certified Spark-Ignited Engines and those certified per Section 9.0, and

6.1.1~~2~~.13 Date that the engine will be in full compliance with this rule.

6.1.2~~3~~ The emission control plan shall identify the type of emission control device or technique to be applied to each engine and a construction/removal schedule, or shall provide support documentation sufficient to demonstrate that the engine is in compliance with the emission requirements of this rule.

6.1.3~~4~~ For an engine being permanently removed from service, the emission control plan shall include a letter of intent pursuant to Section 7.2.

6.2 Recordkeeping

6.2.1 The operator of an engine subject to the requirements of Section 5.2 of this rule shall maintain an engine operating log to demonstrate compliance with this rule. This information shall be retained for a period of at least five years, shall be readily available, and be made available to the APCO upon request. The engine operating log shall include, on a monthly basis, the following information:

6.2.1.1 Total hours of operation,
6.2.1.2 Type of fuel used,
6.2.1.3 Maintenance or modifications performed,
6.2.1.4 Monitoring data,
6.2.1.5 Compliance source test results, and
6.2.1.6 Any other information necessary to demonstrate compliance with this rule.
6.2.1.7 For an engine subject to Section 8.0, the quantity (cubic feet of gas or gallons of liquid) of fuel used on a daily basis.

6.2.2 The data collected pursuant to the requirements of Section 5.~~8~~9 and Section 5.~~9~~10 shall be maintained for at least five years, shall be readily available, and made available to the APCO upon request.

6.2.3 An operator claiming an exemption under Section 4.2 or Section 4.3 shall maintain annual operating records. This information shall be retained for at least five years, shall be readily available, and provided to the APCO upon request. The records shall include, but are not limited to, the following:

6.2.3.1 Total hours of operation,
6.2.3.2 The type of fuel used,
6.2.3.3 The purpose for operating the engine,
6.2.3.4 For emergency standby engines, all hours of non-emergency and emergency operation shall be reported, and

6.2.3.5 Other support documentation necessary to demonstrate claim to the exemption.

6.3 Compliance Testing

The operator of an engine subject to the requirements of Section 5.2 or the requirements of Section 8.0 shall comply with the following requirements:

6.3.1 ~~The requirements of Section 6.3.2 through Section 6.3.4 shall apply to the following engines:~~

~~6.3.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;~~

~~6.3.1.2 Engines subject to Section 8.0;~~

~~6.3.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0;~~

~~6.3.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.~~

All spark-ignited engines and compression-ignited engines that have been retro-fitted with a NOx exhaust control, except certified spark-ignited engines, those certified per Section 9.0, and certified compression-ignited engines, shall comply with Sections 6.3.2 through 6.3.4.

6.3.2 Demonstrate compliance with applicable limits, ppmv or percent reduction, in accordance with the test methods in Section 6.4, as specified below:

6.3.2.1 By the applicable date specified in Section 5.2, and at least once every 24 months thereafter, except for an engine subject to Section 6.3.2.2.

6.3.2.2 By the applicable date specified in Section 5.2 and at least once every 60 months thereafter, for an AO spark-ignited engine that has been retro-fitted with a catalytic emission control device.

6.3.2.3 A portable analyzer may be used to show initial compliance with the applicable limits/standards in Section 5.2 for AO spark-ignited engines, provided the criteria specified in Sections 6.3.2.3.1 to 6.3.2.3.5 are met, and a source test is conducted in accordance with Section 6.3.2 within 12 months from the required compliance date.

6.3.2.3.1 A minimum of 15 minutes of runtime must be measured with data recorded at a minimum of 15, evenly spaced time intervals. Compliance is to be determined with the arithmetic average of the oxygen-corrected data;

6.3.2.3.2 The analyzer shall be calibrated, maintained, and operated in accordance with the manufacturer's specifications and recommendations or a protocol approved by the APCO. Analyzer calibration records shall be made available at the District's request;

6.3.2.3.3 The analyzer shall be checked with EPA protocol span gas at the beginning and end of each test day. The results of these checks shall be recorded and copies submitted to the District with each engine test. If the analyzer exhibits more than a 10% deviation from the span check, the instrument must be re-calibrated. Any analysis performed prior to an end-of-day span check failure shall be void;

6.3.2.3.4 The test results of each engine, including span check results, shall be submitted to the District within 30 days of the test date. Test results shall clearly identify the engine tested including operator, location, permit or registration number, manufacturer, model, and serial number; and

6.3.2.3.5 The analyzer utilized for each check shall be clearly identified in the material submitted with the test results. Identification shall include manufacturer and serial number of the analyzer used, and the last calibration date.

6.3.3 Conduct emissions source testing with the engine operating either at conditions representative of normal operations or conditions specified in the Permit-to-Operate or Permit-Exempt Equipment Registration. For emissions source testing performed pursuant to Section 6.3.2 for the purpose of determining compliance with an applicable standard or numerical limitation, the arithmetic average of three (3) 30-consecutive-minute test runs shall apply. If two (2) of three (3) runs are above an applicable limit, the test cannot be used to demonstrate compliance with an applicable limit. VOC shall be reported as methane. VOC, NOx, and CO concentrations shall be reported in ppmv, corrected to 15 percent oxygen. For engines that comply with a percent reduction limit, the percent reduction of NOx emissions shall also be reported.

6.3.4 In addition to other information, the source test protocol shall describe which critical parameters will be measured and how the appropriate range for these parameters shall be established. The range for these parameters shall be incorporated into the I&M plan.

6.3.5 Engines that are limited by Permit-to-Operate or Permit-Exempt Equipment Registration condition to be fueled exclusively with PUC quality natural gas shall not be subject to the reoccurring source test requirements of Section 6.3.2 for VOC emissions.

6.3.6 Representative Testing

For spark-ignited engines, in lieu of compliance with the applicable requirements of Section 6.3.2, compliance with the applicable emission limits in Section 5.2 shall be demonstrated by submittal of annual emission test results, within 30 days of the test date, to the District, from a unit or units that represents a specified group of units, provided all of the following requirements are satisfied:

6.3.6.1 The units are located at the same stationary source;

6.3.6.2 The units were produced by the same manufacturer, have the same model number or other manufacturer's designation in common, and have the same rated capacity and operating specifications;

6.3.6.3 The units are operated and maintained in a similar manner; and

6.3.6.4 At least 20% of the total number of units are tested during each annual test cycle.

6.3.6.5 The District, based on documentation submitted by the stationary source:

6.3.6.5.1 Determines that the margin of compliance for the identical units tested is significant and can be maintained on an on-going basis; or

6.3.6.5.2 Determines based on a review of sufficient emissions data that, though the margin of compliance is not substantial, other factors allow for the determination that the variability of emissions for identical tested units is low enough for confidence that the untested unit will be in compliance. These factors may include, but are not limited to, the following:

6.3.6.5.2.1 Historical records at the tested unit showing consistent invariant load;

6.3.6.5.2.2 Fuel characteristics yielding low variability and therefore assurance that emissions will be constant and below allowable levels;

6.3.6.5.2.3 Statistical analysis of a robust emissions data set demonstrating sufficiently low variability to convey assurance that the margin of compliance, though small, is reliable.

6.3.6.6 Should any of the representative units exceed the required emission limits, or if the District notifies the operator that the criteria in Sections 6.3.6.1 through 6.3.6.5 have not been fulfilled, each of the units in the group shall individually demonstrate compliance by emissions testing. Failure to complete emissions testing within 90 days of the failed test shall result in the untested units being in violation of this rule. After compliance with the requirements of this section has been demonstrated, subsequent source testing shall be performed pursuant to Sections 6.3.2 or 6.3.6.

6.4 Test Methods

Compliance with the requirements of Section 5.2 shall be determined, as required, in accordance with the following test procedures or any other method approved by EPA and the APCO:

6.4.1 Oxides of nitrogen - EPA Method 7E, or ARB Method 100.

6.4.2 Carbon monoxide - EPA Method 10, or ARB Method 100.

6.4.3 Stack gas oxygen - EPA Method 3 or 3A, or ARB Method 100.

6.4.4 Volatile organic compounds - EPA Method 25A or 25B, or ARB Method 100. Methane and ethane, which are exempt compounds, shall be excluded from the result of the test.

6.4.5 Operating horsepower determination - any method approved by EPA and the APCO.

6.4.6 SOx Test Methods

6.4.6.1 Oxides of sulfur – EPA Method 6C, EPA Method 8, or ARB Method 100.

6.4.6.2 Determination of total sulfur as hydrogen sulfide (H_2S) content – EPA Method 11 or EPA Method 15, as appropriate.

6.4.6.3 Sulfur content of liquid fuel – American Society for Testing and Materials (ASTM) D 6920-03 or ASTM D 5453-99.

6.4.6.4 The SOx emission control system efficiency shall be determined using the following:

$$\% \text{ Control Efficiency} = [(C_{SO2,\ inlet} - C_{SO2,\ outlet}) / C_{SO2,\ inlet}] \text{ X } 100$$

Where:

$C_{SO2,\ inlet}$ = concentration of SOx (expressed as SO_2) at the inlet side of the SOx emission control system, in lb/~~D~~dscf

$C_{SO2,\ outlet}$ = concentration of SOx (expressed as SO_2) at the outlet side of the SOx emission control system, in lb/~~D~~dscf

6.4.7 The Higher Heating Value (hhv) of the fuel shall be determined by one of the following test methods:

6.4.7.1 ASTM D 240-02 or ASTM D 3282-88 for liquid hydrocarbon fuels.

6.4.7.2 ASTM D 1826-94 or ASTM 1945-96 in conjunction with ASTM D 3588-89 for gaseous fuel.

6.5 Inspection and Monitoring (I&M) Plan

The operator of an engine that is subject to the requirements of Section 5.2 or the requirements of Section 8.0 shall submit to the APCO for approval, an I&M plan that specifies all actions to be taken to satisfy the following requirements and the requirements of Section 5.~~8~~9. The actions to be identified in the I&M plan shall include, but are not limited to, the information specified below. If there is no change to the previously approved I&M plan, the operator shall submit a letter to the District indicating that previously approved plan is still valid.

6.5.1 ~~The requirements of Section 6.5.2 through Section 6.5.9 shall apply to the following engines:~~

~~6.5.1.1 Engines that have been retrofitted with an exhaust control device, except those certified per Section 9.0;~~

~~6.5.1.2 Engines subject to Section 8.0;~~

~~6.5.1.3 An AO spark-ignited engine that is subject to the requirements of Section 8.0.~~

~~6.5.1.4 An AO spark-ignited engine that has been retrofitted with a catalytic emission control and is not subject to the requirements of Section 8.0.~~

The requirements of Section 6.5.2 through Section 6.5.9 shall apply to all engines, except certified spark-ignited engines, those certified per Section 9.0, and certified compression-ignited engines.

6.5.2 Procedures requiring the operator to establish ranges for control equipment parameters, engine operating parameters, and engine exhaust oxygen concentrations that source testing has shown result in pollutant concentrations within the rule limits.

6.5.3 Procedures for monthly inspections as approved by the APCO. The applicable control equipment parameters and engine operating parameters will be inspected and monitored monthly in conformance with a regular inspection schedule listed in the I&M plan.

6.5.4 Procedures for the corrective actions on the noncompliant parameter(s) that the operator will take when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust NOx, CO, VOC, or oxygen concentrations.

6.5.5 Procedures for the operator to notify the APCO when an engine is found to be operating outside the acceptable range for control equipment parameters, engine operating parameters, and engine exhaust NOx, CO, VOC, or oxygen concentrations.

6.5.6 Procedures for preventive and corrective maintenance performed for the purpose of maintaining an engine in proper operating condition.

6.5.7 Procedures and a schedule for using a portable ~~NOx~~ emissions analyzer to take NOx and CO emission readings pursuant to Section 5.~~8~~9.9.

6.5.8 Procedures for collecting and recording required data and other information in a form approved by the APCO including, but not limited to, data collected through the I&M plan and the monitoring systems described in Sections 5.8.1

and 5.8.2. Data collected through the I&M plan shall have retrieval capabilities as approved by the APCO.

6.5.9 Procedures for revising the I&M plan. The I&M plan shall be updated to reflect any change in operation. The I&M plan shall be updated prior to any planned change in operation. An engine operator that changes significant I&M plan elements must notify the District no later than seven days after the change and must submit an updated I&M plan to the APCO no later than 14 days after the change for approval. The date and time of the change to the I&M plan shall be recorded in the engine operating log. For new engines and modifications to existing engines, the I&M plan shall be submitted to and approved by the APCO prior to issuance of the Permit-to-Operate or Permit-Exempt Equipment Registration. The operator of an engine may request a change to the I&M plan at any time.

7.0 Compliance Schedules

7.1 Loss of Exemption

The operator of an engine which becomes subject to the emission limits/standards of this rule through loss of exemption shall not operate the subject engine, except as required for obtaining a new or modified Permit-to-Operate or Permit-Exempt Equipment Registration for the engine, until the operator demonstrates that the subject engine is in full compliance with the requirements of this rule.

7.2 Permanent Removal of an Engine

The operator of an engine who elects to permanently remove the engine from service shall comply with all of the following conditions:

7.2.1 Comply with all applicable requirements of this rule until the engine is permanently removed from service;

7.2.2 Submit a letter to the APCO no later than 14 days before the engine is permanently removed from service, stating the intent to permanently remove the engine from service. The engine removal letter can be submitted with the emission control plan, if any; and

7.2.3 Permanently remove the engine from service and officially surrender the Permit-to-Operate or Permit-Exempt Equipment Registration, if any, to the APCO no later than 30 days after the engine is permanently removed from service.

7.3 AO Compression-Ignited Engine

7.3.1 The operator of an AO compression-ignited engine that is subject to Section 5.2, 5.7, 5.8, and that is required to submit an Authority-to-Construct application in order to comply with the requirements of this rule, shall submit the Authority-to-Construct application, and any required Emission Control Plan or I&M Plan, no later than six months before the engine is required to be in compliance with the requirements of Section 5.2, 5.7, and 5.8.

7.3.2 The operator of an AO compression-ignited engine that is subject to Section 5.2, 5.7, 5.8 and that is required to submit a Permit-Exempt Equipment Registration application in order to comply with the requirements of Rule 4702, shall submit the Permit-Exempt Equipment Registration application, and any required Emission Control Plan or I&M Plan, no later than three months before the engine is required to be in compliance with the requirements of Section 5.2, 5.7, and 5.8.

7.3.3 Unless otherwise specified, the operator of an engine that is subject to the requirements of Section 5.2 5.7, and 5.8, of Rule 4702 shall be in full compliance with Rule 4702 by the indicated dates in Table 6~~4~~.

7.4 Non-AO Compression-Ignited Engine

7.4.1 The operator of a non-AO compression-ignited engine that is subject to Section 5.2, 5.7, 5.8, and that is required to submit an Emission Control Plan, an I&M Plan, or an Authority-to-Construct in order to comply with rule requirements, shall submit such document(s) no later than six months before the engine is required to be in compliance with the requirements of Section 5.2.

7.4.2 Unless otherwise specified, the operator of an engine that is subject to the requirements of Section 5.2, 5.7, and 5.8, shall be in full compliance with Rule 4702 by the indicated dates in Table 6~~4~~.

7.5 Spark-Ignited Engine (AO and Non-AO) ~~Non-AO Spark-Ignited Engine~~

7.5.1 An operator with non-AO spark-ignited engines at a stationary source subject to Table 2 or Section 8.0 emission limits, SOx control requirements of Section 5.7, and the SOx monitoring requirements of Section 5.11~~0~~ shall comply with the schedule specified in Table 7~~5~~.

7.5.2 An operator with non-AO spark-ignited engines at a stationary source subject to Table 3 or Section 8.0 emission limits, SOx control requirements of Section 5.7, and the SOx monitoring requirements of Section 5.11 shall comply with the schedule specified in Table 8.

7.5.3 An operator with AO spark-ignited engines at a stationary source subject to Table 5 or Section 8.0 emission limits shall comply with the schedule specified in Table 9.

Table 7~~5~~ Compliance Schedule for Non-AO Spark-Ignited Engines Subject to Table 2 Emission Limits, and SOx Control and Monitoring Requirements

Engines to be in Compliance at a Stationary Source	Emission Control Plan	Authority to Construct and Inspection and Monitoring Plan	Full Compliance
Operator with a single engine at a stationary source			
Single Engine	1/1/12	1/1/13	1/1/14
Operator with at least two engines, but less than 12 engines at a stationary source			
33% or more of the engines subject to Table 2 emission limits as of August 18, 2011	7/1/12	1/1/13	1/1/14
66% or more of the engines subject to Table 2 emission limits as of August 18, 2011	7/1/12	1/1/14	1/1/15
100% of the engines subject to Table 2 emission limits	7/1/12	1/1/15	1/1/16
Operator with at least 12 engines at a stationary source			
25% or more of the engines subject to Table 2 emission limits as of August 18, 2011	7/1/12	1/1/13	1/1/14
50% or more of the engines subject to Table 2 emission limits as of August 18, 2011	7/1/12	1/1/14	1/1/15
75% or more of the engines subject to Table 2 emission limits as of August 18, 2011	7/1/12	1/1/15	1/1/16
100% of the engines subject to Table 2 emission limits	7/1/12	1/1/16	1/1/17

Table 8 Compliance Schedule for Non-AO Spark-Ignited Engines Subject to Table 3 Emission Limits, and SOx Control and Monitoring Requirements

Engines to be in Compliance at a Stationary Source	Emission Control Plan	Authority to Construct and Inspection and Monitoring Plan	Full Compliance
Engines subject to Table 3 emission limits	8/1/22	8/1/22	12/31/23

Table 9 Compliance Schedule for AO Spark-Ignited Internal Combustion Engine Subject to Table 5 Emission Limits			
Engines to be in Compliance at a Stationary Source	Emission Control Plan	Authority to Construct and Inspection and Monitoring Plan	Full Compliance
Rich Burn AO Engines	8/1/22	8/1/22	12/31/23
Lean Burn AO Engines	8/1/28	8/1/28	12/31/29 or 12 years after engine installation, whichever comes later

7.5.3~~2~~ As shown in Table~~s~~ ~~5~~7, 8, and 9, the column labeled:

7.5.3~~2~~.1"Emission Control Plan" identifies the date by which the operator shall submit an emission control plan pursuant to the applicable provisions of Section 6.1. The emission control plan shall identify all the ~~Non-AO~~ spark-ignited engines subject to Table 3~~2~~ or Table 5 emission limits, and SOx control and monitoring requirements. The emission control plan shall identify all the steps to be taken to comply with this rule. If there is no change to the previously approved emission control plan, the operator does not need to submit a new emission control plan. However, the operator shall submit a letter to the District indicating that previously approved plan is still valid.

7.5.32.2"Authority to Construct and Inspection and Maintenance Plan" identifies the date by which the operator shall submit an Authority to Construct (if needed) and an Inspection and Monitoring Plan as specified in the applicable provisions of Section 6.5 for each engine subject to Table 3~~2~~ or Table 5 emission limits, SOx control and monitoring requirements. If there is no change to the previously approved I&M plan, the operator does not need to submit a new I&M Plan. However, the operator shall submit a letter to the District indicating that previously approved I&M plan is still valid.

7.5.3~~2~~.3"Full Compliance" identifies the date by which the operator shall demonstrate that each unit is in compliance with Table 3~~2~~ or Table 5 emission limits, SOx control and monitoring requirements, as applicable.

7.6 Operator of Non-AO Spark-Ignited Engine Who Elects to Pay Fees

In lieu of complying with Table 2 NOx emission limits, the operator of a non-AO spark-ignited engine who elects to pay annual fees under Section 5.2.2.2 and Section 5.6 shall comply with the following requirements:

~~7.6.1 By the date specified in Table 6 submit an Emission Control Plan which includes the following information:~~

~~7.6.1.1 Number of engines at a stationary source that will comply under Section 5.2.2.2,~~

~~7.6.1.2 Location of each engine,~~

~~7.6.1.3 Engine manufacturer, model designation, engine serial number, and Permit-to-Operate number, and~~

~~7.6.1.4 Each engine's rated brake horsepower, fuel type, and type of ignition.~~

~~7.6.2~~ The total annual fees shall be paid to the District in the following manner:

7.6.1~~2~~.1 Payment shall be paid no later than June 30 of each year, for the emissions of the previous calendar year,

7.6.1~~2~~.2 The first payment is due to the District no later than June 30 of the year in which full compliance is required for the specified percent of engines at a stationary source as specified in Table 5 that the operator has opted to pay the annual fees,

7.6.1~~2~~.3 Should June 30 fall on a day when the District is closed, the payment shall be made by the next District working day after June 30, and

7.6.1~~2~~.4 Payments shall continue annually until the engine either is permanently removed from use in the San Joaquin Valley Air Basin and the Permit-to-Operate is surrendered or the operator demonstrates compliance with the applicable Table 2 emission limits.

7.6.1~~2~~.5 The emissions fee for units that operate for less than the full calendar year before demonstrating compliance under Section 5.2, shall be based on the actual fuel used during the portion of the calendar year prior to demonstrating compliance or removing the unit from operation within the San Joaquin Valley Air Basin.

7.6.1.6 The emissions fee compliance option provided under Section 5.2.2.2 shall sunset after December 31, 2023. The final emissions

fee payment shall be due to the District no later than June 30, or by the next District working day after June 30, 2024.

8.0 Alternative Emission Control Plan (AECP)

An operator may comply with the NOx emission requirements of Section 5.2 for a group of engines by meeting the requirements below. An operator that is subject to the requirements below shall also comply with all the applicable requirements of Sections 5.0, 6.0, and 7.0. Only engines subject to Section 5.2 are eligible for inclusion in an AECP.

8.1 During any seven (7) consecutive calendar day period, the operator shall operate all engines in the AECP to achieve an actual aggregate NOx emission level that is not greater than 90 percent of the NOx emissions that would be obtained by controlling the engines to comply individually with the NOx limits in Section 5.2. The operator shall operate engines in the AECP such that

$$AE_{Actual} \leq 0.90\ (AE_{Limit})$$

and shall notify the APCO within 24 hours of any violation of this section.

8.1.1 The actual aggregate NOx emissions (AE_{Actual}) is the sum of the actual NO~~X~~x emissions, over a seven (7) consecutive calendar day period, from all engines in the AECP which were actually operated during that period. AE_{Actual} shall be calculated as follows:

$$AE_{Actual} = \sum_{i} (EF_i)(F_i)(k_i)$$

where:

i identifies each engine in the AECP.

EF_i is the NOx emission factor of the engine established pursuant to Section 8.2 and approved by the APCO.

F_i is the actual total fuel used by the engine during the seven (7) consecutive calendar day period.

k_i is a constant used to convert an engine's fuel use and NOx emission factor to the amount of NOx emitted. k_i is dependent on the engine and the pollutant emitted. Calculation of k_i shall be accomplished using 40 CFR Part 60, Appendix A, Method 19, or an equivalent method approved by EPA, ARB and the APCO.

8.1.2 The estimated aggregate NOx emissions limit (AE_{Limit}) is the sum of the NOx emissions, over a seven (7) consecutive calendar day period, for the same

engines in the AECP which were actually operated during the same period as considered in Section 8.1.1, calculated with the NOx limits of Section 5.2 and the actual fuel usage during that seven (7) consecutive calendar day period. AE_{Limit} shall be calculated as follows:

$$AE_{Limit} = \sum_{i} (EL_i)(F_i)(k_i)$$

where:

i = identifies each engine in the AECP.

EL_i = the NOx emission limit from Section 5.2 for each engine.

F_i = the actual total fuel used by the engine during the seven (7) consecutive calendar day period.

k_i = a constant used to convert an engine's fuel use and NOx emission limit to the amount of NOx emitted. k_i is dependent on the engine and the pollutant emitted. Calculation of k_i shall be accomplished using 40 CFR Part 60, Appendix A, Method 19, or an equivalent method approved by EPA, ARB and the APCO.

8.1.3 Only engines in the AECP which were operated during the seven (7) consecutive calendar day period shall be included in the calculations of AE_{Limit} and AE_{Actual}.

8.1.4 The operator shall, at least one time each day the AECP is used, calculate and record the actual aggregate NOx emissions (AE_{Actual}) and the aggregate NOx emission limit (AE_{Limit}) for the preceding seven (7) consecutive calendar day period.

8.2 The operator shall establish a NOx emission factor limit for each engine. The established NOx emission factor of an engine shall be no less than the NOx emission factor of the engine from the most recent source test conducted pursuant to Section 6.3 and approved by the APCO. The operator shall not operate an AECP engine in such a manner that NOx emissions exceed the established NOx emission factor of the engine.

8.3 The operator shall submit the AECP to the APCO at least 12 ~~18~~ months before compliance with the emission limits in Section 5.2 is required. The AECP shall:

8.3.1 Not be implemented prior to APCO approval.

8.3.2 Be enforceable on a daily basis by the District.

8.3.3 Contain any information necessary to determine eligibility of the engines for alternative emission control, including, but not limited to:

8.3.3.1 A list of engines subject to the AECP. All engines in an AECP shall be under the operational control of a single operator and shall be located at a single stationary source,

8.3.3.2 The NOx emission factor established by the engine operator for each engine pursuant to Section 8.2, and

8.3.3.3 The estimated aggregate NOx emissions calculated according to Section 8.1.2.

8.3.4 Present the methodology for determining equivalency of actual NOx emissions under the proposed AECP as compared to the estimated NOx emissions allowed by this rule.

8.3.5 Detail the method of recording and verifying daily compliance with the AECP.

8.3.6 Demonstrate to the satisfaction of the APCO that the difference between the NOx emission limits of this rule and any lower actual NOx emissions will not be used to increase emissions from the same or another source.

8.3.7 Demonstrate that the engines subject to the requirements of Section 5.2 are in compliance with or on an approved schedule for compliance with all applicable District rules.

8.4 The operator shall submit an updated or modified AECP for approval by the APCO prior to any of the following:

8.4.1 Modification of the engine(s) which would require an Authority-to-Construct;

8.4.2 When new or amended rules are adopted which regulate the emissions from the engines; or

8.4.3 When the NOx emission factor established by the engine operator for an engine pursuant to Section 8.2 is modified.

8.5 In addition to the records kept pursuant to Section 6.2, the operator shall maintain records, on a daily basis, of the parameters needed to demonstrate compliance with the applicable NOx emission limits when operating under the AECP. These records shall be retained for at least five years, shall be readily available, and be made available to the APCO upon request. The records shall include, but are not limited to, the following for each engine unless otherwise indicated:

8.5.1 Total hours of operation,

8.5.2 Type and quantity (cubic feet of gas or gallons of liquid) of fuel used,

8.5.3 The actual NOx emissions limits to be included in the calculation of AE_{Actual} pursuant to Section 8.1.1,

8.5.4 The actual aggregate NOx emissions (AE_{Actual}) for all the engines in the AECP calculated pursuant to Section 8.1.1,

8.5.5 The estimated NOx emissions limits to be included in the calculation of AE_{Limit} pursuant to Section 8.1.2,

8.5.6 The estimated aggregate NOx emissions (AE_{Limit}) for all the engines in the AECP calculated pursuant to Section 8.1.2,

8.5.7 The comparison of the actual aggregate NOx emissions (AE_{Actual}) for all the engines in the AECP and 90 percent of the estimated aggregate NOx emissions (AE_{Limit}) for all the engines in the AECP to demonstrate compliance with Section 8.1, and

8.5.8 Any other parameters needed to demonstrate daily compliance with the applicable NOx emission limits when operating under the AECP.

8.6 For the purpose of determining the quantity of spark-ignited engines in compliance pursuant to Section 7.5, a spark-ignited engine in an AECP shall not be considered to be in compliance until all spark-ignited engines in the AECP that have been designated to meet more stringent NOx emission factors pursuant to Section 8.2 are in compliance with the rule.

9.0 Exhaust Control System Certification Requirements

9.1 To be considered for APCO certification, the manufacturer or operator shall comply with all of the following requirements:

9.1.1 Certification shall be based upon the emission source testing results of a specific exhaust control system,

9.1.2 A source testing protocol shall be submitted in accordance with the provisions of Rule 1081 (Source Sampling) for approval by the APCO prior to conducting the source test. The source testing protocol approved by the APCO shall be strictly adhered to during certification source testing,

9.1.3 Source testing shall be conducted over the range of operating parameters for which the unit(s) will be operated,

9.1.4 The source testing results shall demonstrate compliance with the emission limits of this rule for each model of exhaust control system(s) to be certified,

9.1.5 The source testing procedure and reports shall be prepared by an ARB-approved independent testing laboratory, and shall contain all the elements identified in the APCO-approved source testing protocol,

9.1.6 Source testing shall be conducted no more than 90 days prior to the date of submission of request for certification by the APCO, and

9.1.7 Any additional supporting information required by the APCO to address other performance parameters.

9.2 The manufacturer or operator requesting certification shall submit to the APCO the following information:

9.2.1 Copies of the source testing results conducted pursuant to the requirements of Section 9.1, and other pertinent technical data to demonstrate compliance with the emission limits of this rule,

9.2.2 The applicant shall sign and date the statement attesting to the accuracy of all information in the statement, and

9.2.3 Name and address of the exhaust control system manufacturer or operator, brand name of the exhaust control unit, model number, and description of model of system(s) being certified.

9.3 The APCO will only approve an application for certification to the extent that the requirements of Sections 9.1 through 9.2 are met and the source testing results demonstrate that the emission limits of this rule are met.

9.4 The APCO-approved certification is valid only for the range of operating parameters and conditions for which certification is issued.

9.5 The APCO shall publish a list of certified exhaust control systems after the certification process is completed.

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San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
August 19, 2021

ADOPT PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES)

Attachment C:

Final Draft Staff Report with Appendices for Proposed Amendments to Rule 4702

(131 PAGES)

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Final STAFF REPORT

Proposed Amendments to Rule 4702 (Internal Combustion Engines)

August 19, 2021

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San Joaquin Valley UNIFIED AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

Table of Contents

I. SUMMARY

The San Joaquin Valley Unified Air Pollution Control District (District) is committed to protecting public health for all residents in the San Joaquin Valley (Valley) through efforts to meet health-based state and federal ambient air quality standards with efficient, effective, and entrepreneurial air quality management strategies. One such strategy includes a commitment in the District's *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (*2018 PM2.5 Plan*) to amend District Rule 4702 (Internal Combustion Engines) to reduce emissions of oxides of nitrogen (NOx) from this source category.

Proposed amendments to the rule include more stringent NOx and volatile organic compounds (VOC) emission limits for various types of engines, as well as establishing particulate matter (PM) control requirements. In order to provide better service to stakeholders and affected industry, the proposed amendments will also simplify and clarify existing rule language and standards. Proposed amendments are applicable to agricultural and non-agriculture operated internal combustion engines.

A. Reasons for Rule Development and Implementation

The U.S. Environmental Protection Agency (EPA) periodically reviews and establishes health-based air quality standards for ozone, particulates, and other pollutants. Although the Valley's air quality is steadily improving, it experiences unique and significant difficulties in achieving these increasingly stringent standards. The Valley's challenges in meeting National Ambient Air Quality Standards (NAAQS) are unmatched in the nation due to the region's unique geography, meteorology, and topography. In response to the latest federal mandates, and to improve quality of life for Valley residents, the District has developed and implemented multiple generations of rules on various sources of air pollution. Valley businesses are currently subject to the most stringent air quality regulations in the nation. Since 1992, the District has adopted nearly 650 rules to implement an aggressive on-going control strategy to reduce emissions, resulting in air quality benefits throughout the Valley. Similarly, the California Air Resources Board (CARB) has adopted stringent regulations for mobile sources. Together, these efforts represent the nation's toughest air pollution emissions controls and have greatly contributed to reduced ozone and particulate matter concentrations in the Valley.

Due to the significant investments made by Valley businesses and residents, and stringent regulatory programs established by the District and CARB, air quality over the past few years has continued to set new clean air records. Despite the significant progress under these regulations, greatly aided by the efforts of Valley businesses and residents, many air quality challenges remain, including attainment of the federal air quality standards for fine particles less than 2.5 micrometers in diameter (PM2.5), as addressed in the District's recently adopted *2018 PM2.5 Plan*.

The *2018 PM2.5 Plan* contains a comprehensive set of local and state measures that build on existing measures to further reduce air pollution from stationary, area, and mobile sources throughout the Valley. Attaining the multiple federal PM2.5 standards by the mandated deadlines is not possible without significant additional reductions in directly emitted PM2.5 and key PM2.5 precursors like NOx. The attainment strategy includes a suite of innovative regulatory and incentive-based measures, supported by robust public education and outreach efforts to reduce emissions of PM2.5 in the Valley. One of the measures included in the plan is to amend District Rule 4702 (Internal Combustion Engines) as a necessary cost-effective measure for further reducing NOx emissions, and bringing the Valley into attainment with federal PM2.5 standards within the mandated federal deadlines.

Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, District staff are proposing several modifications to Rule 4702 to reduce emissions from stationary internal combustion engines operating in the San Joaquin Valley. This rule amendment project is proposed to satisfy the commitments in the District's *2018 PM2.5 Plan*, and to ensure that Rule 4702 requires the implementation of state and federal standards of Reasonably Available Control Technology (RACT), Best Available Retrofit Control Technology (BARCT), and Most Stringent Measures (MSM).

B. Health Benefits of Implementing Plan Measures

Exposure to PM2.5 and ozone has been linked to a variety of health issues, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. PM2.5 is a major health risk because it can be inhaled more deeply into the gas exchange tissues of the lungs, where it can be absorbed into the bloodstream and carried to other parts of the body. CARB explains that even short-term exposure of less than 24 hours can cause premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5 and ozone.

As NOx emissions are a key precursor in the formation of both ozone and PM2.5, continuing to assess the feasibility of achieving additional NOx reductions across the Valley is critical to improving PM2.5 and ozone throughout the region. PM2.5 emissions are characterized by a unique combination of direct and indirectly formed constituents. NOx emissions are a precursor to the formation of ammonium nitrate, which is a large portion of total PM2.5 during the Valley's peak winter season. NOx is also a precursor to ozone, which is formed when heat and sunlight interact with NOx and VOC's. Harmful ozone is predominantly formed at the surface during the summer season in the

Valley. The District has long worked to reduce NOx emissions as the primary precursor for the formation of ozone and PM2.5 in the Valley.

To address federal health-based standards for ozone and PM2.5 and improve public health, the District develops attainment plans and implements control measures to lower direct and precursor emissions throughout the San Joaquin Valley. The proposed amendments will achieve additional reductions in NOx emissions as requirements are implemented by affected sources, and new technologies are installed. New regulatory and incentive-based measures proposed by both the District and CARB, combined with existing measures achieving new emissions reductions, are necessary to achieve the emissions reductions required to attain the health-based federal standards as expeditiously as practicable, and will improve public health as emissions reductions are realized.

C. Description of Project

The Governing Board first adopted Rule 4702 in August of 2003, and last amended this rule in 2013. Rule 4702 applies to internal combustion (IC) engines rated at 25 brake horsepower (bhp) or greater. Facilities with units subject to this control measure represent a wide range of industries, including but not limited to oil and gas production, petroleum refineries, landfills, wastewater treatment plants, water districts, schools, and electrical power generation facilities. In August 2015, EPA found that this rule implements RACT, as discussed in EPA's Technical Support Document (TSD) for the *Proposed Rulemaking and District Final Rule for the California SIP* for Rule 4702.[1] Furthermore, in February 2020, EPA found that this rule implements Best Available Control Measures (BACM) and MSM, as further discussed in EPA's TSD for the approval of the *San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS*.[2]

The proposed amendments to Rule 4702, which satisfy commitments in the *2018 PM2.5 Plan*, include lowering NOx and VOC emissions for spark-ignited IC engines, clarifying definitions, and updating test methods. Through the implementation of the proposed Rule 4702 amendments, from this source category an estimated 43% reduction of NOx emissions will be achieved by 2024, as well as an estimated 72% reduction of VOC emissions. An estimated total 49% reduction of NOx emissions will occur by 2030, as well as an estimated total 75% reduction of VOC emissions. An estimated 0.62 tons per day (tpd) reduction of NOx emissions will be achieved by 2024, with an estimated total 0.70 tpd reduction of NOx emissions by 2030. In addition to these NOx emission reductions, there will be an estimated 0.31 tpd of VOC emission reductions achieved by 2024, with an estimated total 0.32 tpd of VOC emissions

[1] Technical Support Document for EPA's Notice of Proposed Rulemaking and Direct Final Rule for the California State Implementation Plan San Joaquin Valley Unified Air Pollution Control District Rule 4702, Internal Combustion Engines. (November 2015).

[2] U.S. Environmental Protection Agency: Technical Support Document for EPA's Technical Support Document "EPA Evaluation of BACM/MSM" for the San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQA. February 2020.

reduced by 2030. Emission reductions achieved through the proposed requirements of this rule amendment will contribute towards the Valley's attainment of the health-based federal PM2.5 and ozone standards, and satisfy the commitments in the *2018 PM2.5 Plan.*

Table 1 - Estimated Emission Reductions for Compliance Years

Pollutant	2024 Emission Reductions (tpd)	2030 Emission Reductions (tpd)
NOx	0.62	0.70
VOC	0.31	0.32

Table 2 - Estimated Emission Reductions 2024-2030

Pollutant	2024*	2025*	2026*	2028*	2029*	2030*
NOx	0.62	0.61	0.60	0.59	0.59	0.70
VOC	0.31	0.31	0.30	0.29	0.29	0.32

*Emission Reductions in tons per day

D. Rule Development Process

As part of the rule development process, District staff conducted public workshops to present and discuss proposed amendments to Rule 4702. Information about public meetings was broadly shared to members of the public, source operators, consultants, vendors and manufacturers of control technologies, trade associations, and AB 617 community steering committee members. District staff conducted a public Scoping Meeting on December 5, 2019 and public workshops in September 2020, November 2020, and June 2021. Updates were also presented throughout the rulemaking process at multiple public meetings of the Citizens Advisory Committee, Environmental Justice Advisory Group, and the District Governing Board.

At the public workshops, District staff presented the objectives of the proposed rulemaking project. A draft rule was published for public review on December 9, 2020, and an updated draft was published on June 28, 2021. Throughout the rule development process, District staff solicited information from affected source operators, consultants, vendors and manufacturers of control technologies, and trade associations on the technological feasibility and compliance cost information that would be useful in developing amendments to Rule 4702. The comments received from the public, affected sources, and interested parties during the public outreach and workshop process were incorporated into the draft rule as appropriate.

Pursuant to state law, the District is required to perform a socioeconomic impact analysis prior to adoption, amendment, or repeal of a rule that has significant air quality benefits or that will strengthen emission limitations. As part of the District's

socioeconomic analysis process, the District hired a socioeconomic consultant to prepare a socioeconomic impact report. The results of the socioeconomic analysis are included in this report (Appendix D).

The proposed rule amendments and draft staff report with associated appendices were published for 30-day public review and comment prior to the public hearing to consider the adoption of the proposed amendments to Rule 4702 by the District Governing Board. The public hearing is scheduled on August 19, 2021.

II. DISCUSSION

Internal Combustion (IC) engines operate by compressing and igniting a combustible mixture of fuel and oxygen, generally from ambient air, in the combustion chamber of the engine. An IC engine allows the energy released by ignition of the fuel mixture to be utilized to perform useful work, such as powering equipment. The main types of engines are spark-ignited engines and compression-ignited (or diesel) engines. Spark-ignited engines use a spark plug to ignite the air/fuel mixture, and may use a variety of volatile fuels, such as natural gas, propane, butane, liquefied petroleum gas, oil field gas, gasoline, digester gas, landfill gas, methanol, or ethanol. Compression-ignited engines rely on heating of the inducted air during the compression stroke to ignite injected fuel, usually diesel fuel. In addition to being classified as either compression-ignited or spark-ignited, IC engines can be further divided into two-stroke and four-stroke engines. Large spark-ignited engines are usually four-stroke, but some applications that require smaller lighter-weight engines use two-stroke spark-ignited engines. Most diesel engines are also four-stroke engines.

IC engines may operate as either “rich-burn” or “lean-burn” engines. Rich-burn IC engines operate with an air to fuel ratio that results in stoichiometric or very near stoichiometric combustion of the fuel, and have little excess oxygen in the exhaust. Lean-burn engines combust fuel with excess air and have higher concentrations of oxygen in the exhaust. Diesel compression-ignited IC engines are all lean-burn IC engines, while spark-ignited IC engines may be either rich-burn or lean-burn. The air needed for combustion of fuel in an IC engine may be provided through natural aspiration in which the combustion air is atmospheric pressure, or the IC engine may use a turbocharger to provide greater amounts of combustion air at higher pressure. Turbocharged IC engines have greater power output for the same size engine when compared to naturally aspirated IC engines.

Internal combustion engines are used for numerous activities, such as powering pumps, compressors, or electrical generators. Engines are used by a variety of private businesses and public agencies throughout the Valley. Examples of businesses and industries that use engines that could be affected by this project include schools and universities, agriculture, oil and gas production and pipelines, petroleum refining, manufacturing facilities, food processing, electrical power generation, landfills, waste

water treatment facilities, and water districts. Many of the permitted compression-ignited engines in the District are emergency standby engines that provide backup power when electric service is interrupted.

Stationary IC engines are found throughout the District and can be used in multiple capacities, each with particular considerations and constraints. It's due to these conditions that each engine type has been broken down into multiple categories, each individually evaluated to determine the most feasible emissions limits, as further discussed in the "Proposed Amendments" section of this report. Emissions limits are proposed depending on the type of the engine, with specific limits proposed for spark-ignited engines depending on the air to fuel mixture of the engine.

Rule 4702 has historically established limits for engines used at agricultural operations (AO engines) that are separate from the requirements for engines used at other types of operations (Non-AO engines). Due to the age, location and operational requirements of engines used at agricultural operations, there are a number of considerations that must be taken into account when determining their potential emissions limits and technological feasibility. AO spark-ignited engines are generally located in rural and remote areas. With ongoing farm labor shortages, it is difficult and often economically infeasible for agricultural operators to obtain and retain skilled labor to provide the frequent and complex maintenance required for retrofitted or new engines equipped with advanced emission controls. Lower emissions limits may also lead to increased maintenance requirements and monitoring efforts. Due to these factors, AO engines must be considered in their own category, and were given extensive review when determining the proposed limits and compliance dates. However, even with these challenges, the District has determined that there are lower cost technologies available now that are able to reduce the emissions from these engines with a lower maintenance cost.

A. Emissions Control Technologies

Over the years, the District has adopted numerous generations of rules and rule amendments for engine units greater than or equal to 50 bhp that have significantly reduced NOx and VOC emissions from this source category. As part of these regulatory efforts, hundreds of engines in the Valley have been equipped with the best available NOx and VOC control technologies. Even though significant effort has already been made to reduce emissions from this source category, the possibility of further reducing emissions from units greater than 50 bhp is evaluated in the following discussion.

The two primary methods of controlling NOx emissions from engines is to retrofit them with either a selective catalytic reduction (SCR) system or non-selective catalytic reduction (NSCR) system to reduce NOx formation. NSCR systems are also effective at reducing VOCs, while SCR systems require an additional oxidization catalyst for VOC control. These controls treat the pollutants formed before they are emitted into the

atmosphere. As mentioned above, the District also considered the feasibility of reducing emissions through converting engines to an electric motor.

Selective Catalytic Reduction Systems

A SCR system is a way to reduce NOx from lean-burn engines. NOx is reduced to molecular nitrogen by adding an exhaust gas treatment system consisting of a catalyst module and a reagent injection system to add the reagent to the engine exhaust. SCR systems must operate at a certain temperature range to effectively reduce NOx in the exhaust gas by injecting either ammonia stored in aqueous or anhydrous form and generated on demand or released from urea into the post-combustion zone of the engine. SCR systems have significant initial capital cost. The installed cost of an SCR system for a lean-burn IC engine is estimated to be over $120,000 to $300,000 depending on the size of the unit. Additionally, the annual operation and maintenance cost for a single SCR system is between $16,000 and $60,000, depending on the size of the unit. Due to these factors, SCR systems are not a cost effective control system for many lean-burn engines at this time, such as the typical size range IC engines used in agricultural operations.

Non-Selective Catalytic Reduction Systems

NSCR systems, also known as 3-way catalysts, work as a way to reduce NOx from rich-burn engines. The catalyst oxidizes exhaust gas pollutants - both hydrocarbons and carbon monoxide - and reduce NOx into water, molecular nitrogen and carbon dioxide. The NSCR systems have nominal capital costs. The installation cost of a NSCR is $6,000 to $11,000 depending on the size of the unit. In addition to installation costs, there are additional operation and maintenance costs between $700 and $3,000. Due to these factors, NSCR is the most cost-effective control system for use on rich-burn engines at this time.

Electrification and Solar

To ensure that all potential emission reduction opportunities are evaluated, the District performed a review of electric and solar powered motors. Electric and solar powered motors are commercially available and generally cost about the same as similarly sized spark-ignited units. Economic impacts would also be influenced by the increasing cost of electricity in California as electricity rates rose 48% from 2010 to 2020 (9.8 cents/kW-hr to 14.55 cents/kW-hr) based on annual data for 2020 provided by the U.S. Energy Information Administration.[3] Additionally, for solar powered motors, there is an inconsistency to how much electricity can be produced at any location, based on the availability of direct sunlight and the amount of space a facility is able to designate towards solar panels. The specific consideration of crop land would come into play for

[3] U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report, U.S. Energy Information Administration, Form EIA-861, Annual Electric Power Industry Report, U.S. Energy Information Administration, Form EIA-923, Power Plant Operations Report and predecessor forms.

engines that operate as a part of an agricultural facility, as many farmers would have difficulty designating space for the solar equipment. In addition, there is a lack of existing electric infrastructure in many areas of the Valley, including some farms and oil fields. There would be considerable costs associated with the line extension and other technology necessary to gain access to electricity or solar power in these remote locations.

For facilities that lack the infrastructure needed to connect to the electrical power grid, there are additional technologies that would be necessary in order to operate an electric or solar powered pump motor. These facilities could potentially incur much larger costs because of the need to install excess capacity, and water storage or batteries to store the electrical energy generated when the solar system was not generating electricity. The installation and maintenance of these systems could raise the costs of an electric engine/solar-system exponentially, with estimated cost-effectiveness values of $150,000 - $260,000, or higher, per ton of emissions reduced for each unit installed, depending on the size of the engine.

Due to the technological and economic challenges, it is not feasible for the District to set a standard requiring engines to be replaced with electric motors or solar-powered motors at this time. To promote the use of electric motors where feasible, the District currently offers an incentive funding grant covering up to 85% of the cost to install an electric motor to replace an existing IC engine.

III. CURRENT RULE 4702 AND PROPOSED AMENDMENTS

A. Current Rule 4702

Rule 4702 (Internal Combustion Engines Phase 2) was adopted in August 2003 and was last amended in November 2013. The purpose of Rule 4702 is to limit NOx, CO, and VOC emissions from stationary engines. The rule applies to any stationary engines with a rated brake horsepower (bhp) greater than 25. The rule requirements are organized into two engine categories: those used in agricultural operations and those used in non-agricultural operations. The existing NOx concentration limits in Rule 4702 range from 11 parts per million by volume (ppmv) to 75 ppmv corrected to 15% O_2, depending on engine category. The VOC and CO concentration limits range from 250 to 750 ppmv (depending on engine category) and 2,000 ppmv, each corrected to 15% O_2, respectively.

District Rule 4702 requires that emission from non-emergency IC engines be periodically tested and monitored to ensure ongoing compliance with applicable emission limits. For certified spark-ignition IC engines used in agricultural operations and certified compression-ignition engines, the certification ensures ongoing compliance with the emission standards because the certified emission rates take into account durability and expected deterioration rates. Furthermore, the Tier 4F certification

standard mandates the use of sophisticated engine management software that automatically monitors several key parameters such as catalyst back pressure, temperature, reagent level, flowrate, etc., and will automatically depower the engine if any of these parameters drift out of range of the manufacturer's certified specifications. Each Tier 4F engine manufacturer also publishes recommended engine and emission control system component monitoring and maintenance intervals to ensure the engine and emission control system function properly and continue to meet the required certified emission standards. To ensure that these engines will continue to meet the required emission standards, Sections 5.10.2 and 5.10.3 of District Rule 4702 require that these engines must be operated as recommended by the engine manufacturer or emission control system and periodic monitoring of operational characteristics recommended by the engine manufacturer or emission control system supplier and approved by the APCO. The use of certified engines combined with the required monitoring of operational characteristics recommended by the engine manufacturer or emission control system supplier ensure that these engines will comply with the applicable emission standards throughout the useful life of the unit.

There are currently no facilities in the District that use an Alternative Emission Control Plan (AECP); however, the District is not proposing to remove the plan as an option in the proposed rule in order to provide facilities with an additional option to comply with the rule that will achieve equal or greater reductions. All engines subject to Rule 4702, including any engines for which a facility may choose to use an AECP as a compliance option must comply with all applicable State and Federal requirements. Emissions reductions required by any other federally enforceable provision will not be credited through this rule. Section 8.2 requires the operator to establish a NOx emission factor for each engine in the AECP that must be approved by the APCO. Any engine in an AECP shall not be operated in a manner that NOx emissions exceed the established NOx emission factor of the engine. Additionally, Section 8.3.6 of the rule requires that engines under the AECP must demonstrate that the difference between the lower actual NOx emissions will not be used to increase emissions at the same or another source. This demonstration is required in order to ensure that emission reductions will either be equal to or greater than those that would be achieved by the rule without the use of an AECP.

B. Proposed Amendments to Rule 4702

In an effort to simplify rule language and clarify existing requirements, expired language would be removed, and some rule requirements would be reorganized to other sections of the rule. The following paragraphs detail the proposed modifications to rule language. For further information on how the proposed limits were determined see the Incremental Cost Analysis in Appendix C. See Proposed Rule 4702 for exact language.

Section 1.0 Purpose
The Purpose Section would be updated to include Particulate Matter. Particulate Matter Emission Control Requirements were added to the rule as Section 5.8, and as such the purpose of the rule was amended to encompass the new requirements.

Section 2.0 Applicability
No changes are proposed for Section 2.0 at this time.

Section 3.0 Definitions
The Definitions Section would be updated by removing expired language, and some existing definitions would be updated for clarity.

Section 4.0 Exemptions
No changes are proposed for Section 4.0 at this time.

Section 5.0 Requirements

Section 5.1 Stationary Engines Rated at Least 25 Brake Horsepower, Up To, and Including 50 Brake Horsepower and Used in Non-Agricultural Operations
Proposed amendments would update this section to remove outdated requirements.

Section 5.2 Engines Rated Greater than 50 Brake Horsepower

Section 5.2.2 Non-AO Spark-Ignited Engine Emission Concentration Limits
Updates in this section would specify the emission concentration limits for non-AO spark-ignited engines greater than 50 bhp, effective pursuant to the compliance schedule specified in Section 7.5. The proposed Table 3 of the rule would create an 11 ppmv NOx limit for categories: Rich-burn Waste Gas Fueled, Cyclic Loaded, Not Listed Above and Limited Use. For categories of Lean-Burn Gas Compression, and Lean-Burn Waste Gas, staff proposes a NOx limit of 40 ppmv. Additionally, the category of Lean-Burn Two-Stroke, Gaseous Fueled, >50 bhp and <100 bhp would be removed, as there are no engines in this category. For VOC limits, District staff proposes a limit of 90 ppmv for all categories. The current CO limit of 2,000 ppmv would be maintained for all categories. Keeping the existing CO emission limits in the current rule would allow engine manufacturers and emission control system manufacturers to have the much-needed flexibility to be able to achieve more stringent NOx emissions limits under varying field operating conditions and applications, without having to overly consider CO emissions levels. Emissions limits were proposed based on the results of a comprehensive review of the existing engine inventory in the Valley, available control technology (including what is currently required for BACT),requirements in other air districts, and a cost-effectiveness analysis of requiring further controls for existing engines (as further discussed in Appendix C).

Language would be added in Section 5.2.2.2 explaining that after December 31, 2023, the option of paying an annual fee in lieu of complying with the NOx emission limits

would sunset, and no longer be applicable within Rule 4702. After 2023, all Non-AO Spark-Ignited engines must meet the limits of the rule's Table 3 and the option detailed in Section 5.6 would no longer be available.

Table 3 - Proposed Limits for Non-AO Spark Ignited Engines, as included in Table 3 of Proposed Rule 4702

Table 3 Emission Limits for a Spark-Ignited Internal Combustion Engine Rated at >50 bhp Used Exclusively in Non-AO (All ppmv limits are corrected to 15% oxygen on a dry basis). Emission Limits are effective according to the compliance schedule specified in Section 7.5, Table 8.			
Engine Type	NOx Limit (ppmv)	CO Limit (ppmv)	VOC Limit (ppmv)
1. Rich-Burn			
a. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	11	2000	90
b. Cyclic Loaded, Field Gas Fueled	11	2000	90
c. Limited Use	11	2000	90
d. Rich-Burn Engine, not listed above	11	2000	90
2. Lean-Burn Engines			
a. Limited Use	11	2000	90
b Lean-Burn Engine used for gas compression	40	2000	90
c. Waste Gas Fueled (≥ 50% total monthly heat input from waste gas based on hhv)	40	2000	90
d. Lean-Burn Engine, not listed above	11	2000	90

A description would be added to Waste Gas Fueled engines to determine what percent of fuel intake must be waste gas in order to qualify for the category. Additionally, language would be added to clarify the compliance schedule, and control/monitoring requirements.

Section 5.2.3 AO Spark-Ignited Engine Emission Limits
Updates in this section would clarify compliance dates and update emission limits/standards. Table 5 of the rule would be added in connection with new language that specifies the current AO Spark-Ignited Emissions limits would continue to be in effect until the limits of Table 5 take effect. Within the rules Table 5, District staff proposes a 0.15 g/bhp-hr or 11 ppmv NOx limit for rich-burn engines, a 0.6 g/bhp-hr or

43 ppmv NOx limit for lean-burn engines and a 90 ppmv VOC limit for all engines in this category, effective pursuant to the compliance schedule specified in Section 7.5.

The proposed limits for AO engines were established after extensive research into available control technologies and cost effectiveness analyses, in addition to extensive conversations with manufacturers and business owners as to the capability of engines used to power agricultural irrigation pumps. AO rich-burn engines are proposed at a NOx limit of 11 ppmv, as that has been determined to currently be the most technologically feasible and cost-effective limit. For AO lean-burn engines, the proposed limit of 0.6 g/bhp-hr or 43 ppmv was determined as the most stringent emissions limit feasible for this category, based on a comprehensive review of the lowest currently achievable emissions limits, and due to the technological and economic infeasibility of retrofitting these types of engines with SCR systems. On an engine-by-engine basis, all AO engines in the Valley would be able to meet the proposed limits using one or more of the following techniques: upgrading a NSCR system, converting from lean-burn to rich-burn and retrofitting with NSCR, replacing the engine, or refined tuning of the engine.

Table 4 - Proposed Limits for AO Spark-Ignited Engines, as included in Table 5 of Proposed Rule 4702

Table 5 Emission Limits/Standards for a Spark-Ignited Internal Combustion Engine >50 bhp Used Exclusively in AO (All ppmv limits are corrected to 15% oxygen on a dry basis). Emission Limits are effective according to the compliance schedule specified in Section 7.5, Table 9.			
Engine Type	NOx Limit	CO Limit	VOC Limit
1. Rich-Burn	0.15 g/bhp-hr or 11 ppmv	2000 ppmv	90 ppmv
2. Lean-Burn	0.6 g/bhp-hr or 43 ppmv	2000 ppmv	90 ppmv

Section 5.2.4 Certified Compression-Ignited Engines (AO and non-AO)
Within Section 5.2.4, the table that details the 'Emission Standards and Compliance Schedule for Compression-Ignited Internal Combustion Engine' would be amended to remove the 'Greater than 500 bhp and greater than or equal to 1000 annual operating hours' category of non-certified compression-ignited engines. There are no engines in the District's inventory that fall under the 'Greater than 500 bhp and greater than or equal to 1000 annual operating hours' category, and current rule requirements would not permit the future installation of engines in the category. The current rule requires that all newly installed engines be the cleanest certified engine available at the time of installation, and as such no new non-certified compression-ignited engines can be installed.

The commitment in the *2018 PM2.5 Plan* was for the District to evaluate the amendment of limits for spark-ignited engines (both AO and non-AO). In support of expeditious attainment of the federal standards, District staff performed an analysis to determine if it would be feasible to amend Compression-Ignited (CI) engines limits,

including the possibility of requiring the replacement of Tier 3 and Tier 4-interim engines with Tier 4-final engines. The current requirements of Rule 4702 require that operators of CI engines install the cleanest certified engine at the time of installation. Additionally, the requirements in Rule 4702 also specify that, upon engine replacement, an operator must install the cleanest certified engine available. Due to the stringency of these requirements, and the potentially high cost-effectiveness of replacing an engine that was recently replaced due to the existing requirements in the rule, District staff are not proposing to amend limits for CI engines at this time. Emission limits for CI engines may be further evaluated as a part of future rule development efforts.

Section 5.6 Payment of Annual Fee In Lieu of Complying with a NOx Emission Limit
Language would be added in this section to detail the sunset of the emission fee compliance option by December 31, 2023 and to require that the last emissions fee must be paid by July 1, 2024.

Section 5.7 Sulfur Oxides (SOx) Emission Control Requirements
Language in this section would be updated to require agricultural engines to comply with the current SOx control requirements in place for Non-AO engines. Due to this new requirement, a provision has been added to this section whereby agricultural engines fueled with digester gas which are installed before December 31, 2021, must limit their fuel sulfur content to no more than 250 ppmv. All other agricultural engine types must either limit their gaseous fuel sulfur content to no more than 5 grams of total sulfur per 100 standard cubic feet, or install and properly operate an emission control system that reduces SO2 emissions by at least 95% by weight as determined by the test method specified in Section 6.4.6. It should be noted that the majority of agricultural digester engines comply with the requirements of Section 5.7.6 already due to BACT requirements in place at the time of unit installation, however, this SOx limit was established based on a cost-effectiveness analysis of requiring a retrofit control for the few existing agricultural digester engines that do not currently have an add-on scrubber for SOx.

Section 5.8 Particulate Matter (PM) Emission Control Requirements
This section would be added to the rule to establish particulate matter requirements for IC engines operated in the Valley. The PM control requirements for spark-ignited engines would be based on the SOx requirements of Section 5.7, as PM emissions from spark-ignited engines are primarily due to SOx in the fuel source. Compression-ignited engines would continue to be required to comply with the applicable CARB/EPA Tier certification standard at the time of installation, per Table 6 in the Rule. These requirements would go into effect based on the compliance schedule specified in Sections 5.2.4 and 7.0 of the Rule.

Section 5.9 Monitoring Requirements: Non-AO Spark-Ignited Engines and Engines in an AECP
Language would be added in this section to update the types of emissions required to be measured using a portable analyzer to specifically include CO and oxygen

concentrations, in addition to NOx.

Section 5.10 Monitoring Requirements: All Other Engines
Language would be added in this section to indicate the types of emissions required to be measured using a portable analyzer to include CO and oxygen. Also, additional language would be added to clarify that any engine in this category that has been retrofitted with a NOx exhaust control shall take NOx, CO, and Oxygen readings at least once every 24 months. Language would be added to outline the timeline in which spark-ignited and compression-ignited engines would have to comply with Section 5.10.5, as well as which engines would be exempt.

Section 5.11 SOx Emissions Monitoring Requirements
The language of this section would be amended in order to include AO engines as being subject to the requirements, which had previously only applied to non-AO engines.

Section 6.0 Administrative Requirements
Proposed updates would amend this section to remove outdated requirements. Additionally, table references would be added to clarify engine requirements.

Section 6.1 Emission Control Plan
Proposed amendments update which engines are required to submit an emissions control plan. Engines that fall under the categories of spark-ignited non-AO 'Rich-Burn Engine, not listed above' or 'Lean-Burn engine not listed above' in Table 3 of the rule would not be subject to filing an emission control plan, as they are already required to meet a limit of 11 ppmv NOx. All other categories are required to submit an emission control plan.

Section 6.3 Compliance Testing
Draft amendments clarify which engines would be required to perform compliance testing.

Section 6.5 Inspection and Monitoring (I&M) Plan
Proposed amendments clarify the applicable engines in Section 6.5.1. Additionally, language would be added to Section 6.5.7 to indicate the types of emissions required to be measured during each required portable emissions analyzer monitoring.

Section 7.0 Compliance Schedule
Draft amendments would update this section to update requirements, including reviewing and updating compliance schedules, renumbering Sections as appropriate, and removing language no longer applicable.

Section 7.3 AO Compression-Ignited Engine
Language would be added to this section to indicate that these engines would be subject to the SOx and PM2.5 control requirements in Section 5.7 and 5.8.

Section 7.5 AO and Non-AO Spark-Ignited Engine
Proposed amendments to this section would add language to reference control requirements for both AO and Non-AO Spark-Ignited engines, and associated compliance timelines. Table 8 of the rule is proposed to include the compliance schedule for non-AO spark-ignited engines. The proposed compliance schedule would take place over 2.5 years, with the emission control plan and the authority to construct (ATC), inspection, and monitoring plans due by August 1, 2022, and full compliance with emissions limits required by December 31, 2023.

Table 9 of the rule is proposed to include the compliance schedule for AO Spark-Ignited Internal Combustion Engines. Operators with rich-burn engines would have until December 31, 2023 to bring their engines into full compliance with proposed emissions limits. The emission control plan, the ATC, inspection, and monitoring plan would all be due by August 1, 2022. Operators with lean-burn engines would have to be in full compliance with new emissions limits by December 31, 2029, or 12 years after installation of the unit, whichever comes later. The District determined that later compliance dates were appropriate for AO lean-burn engines due to the high costs incurred by operators to replace these units, and to allow for the useful life of the equipment currently being used to be met.

Table 5 - Proposed Compliance Dates for Non-AO Spark-Ignited Engines, as included in Table 8 of Proposed Rule 4702

Table 8 Compliance Schedule for Non-AO Spark-Ignited Engines Subject to Table 3 Emission Limits, and SOx Control and Monitoring Requirements			
Engines to be in Compliance at a Stationary Source	Emission Control Plan	Authority to Construct and Inspection and Monitoring Plan	Full Compliance
Engines subject to Table 3 emission limits	August 1, 2022	August 1, 2022	December 31,2023

Table 6 - Proposed Compliance Dates for AO Spark-Ignited Engines, as included in Table 9 of Proposed Rule 4702

Table 9 Compliance Schedule for AO Spark-Ignited Internal Combustion Engine Subject to Table 5 Emission Limits			
Engines to be in Compliance at a Stationary Source	Emission Control Plan	Authority to Construct and Inspection and Monitoring Plan	Full Compliance
Rich-Burn AO Engines	August 1, 2022	August 1, 2022	December 31, 2023
Lean-Burn AO Engines	August 1, 2028	August 1, 2028	December 31, 2029 or 12 years after engine installation, whichever comes later

Section 7.6 Operator of Non-AO Spark-Ignited Engine Who Elects to Pay Fees
Language would be added to sunset the emissions fee compliance option after December 31, 2023; this option would no longer be applicable for Rule 4702. Section 7.6.1 from the existing rule, which detailed the Emission Control Plan requirements would also be removed.

Section 8.0 Alternative Emission Control Plan (AECP)
Language in this section was amended to clarify when an AECP would need to be submitted. This section would amend the date in which the AECP must be submitted to the APCO from 18 months to 12 months before compliance with the emission limits for consistency with other permitting requirements. No additional amendments to Section 8.0 are proposed in this rule amendment, as the section in the current Rule 4702 meets or exceeds all federal requirements in place for internal combustion engines.

IV. ANALYSIS

A. Emission Reduction Analysis

In order to determine the emission reductions associated with the proposed changes, District staff queried the District Permit Services Database for all non-emergency engines, and then sorted the engines into categories based on the types of operations. The District identified 806 non-emergency, spark-ignited engines in total. Based on the permit limits of engines in the Districts inventory, 594 engines are estimated to exceed proposed rule limits and would be required to be replaced or modified in order to meet proposed emissions limits.

Estimated NOx reductions are based on the permit limits of all spark-ignited engines, and are used for cost-effectiveness purposes. However, for SIP purposes, a percentage reduction from each pollutant is calculated from three-year average data,

and that percentage will be used to estimate the emission reductions from the proposed rule. For the years 2024 and 2030, the percentage reductions will be applied to the emissions inventory data for spark-ignited engines from CEPAM Version 1.5, which was used as the inventory for the *2018 PM2.5 Plan*. These reductions are shown in Table 7 of this report.

Table 7 – SIP Emissions Reductions

	NOx	VOC
2024—2029 Reduction Percentage	43%	72%
2030 and Later Reduction Percentage	49%	75%
2024 Emissions Reductions (tons per day)	0.62	0.31
2030 Emissions Reductions (tons per day)	0.70	0.32

Details of the emissions reduction analysis is contained in Appendix B of this staff report.

B. Cost Effectiveness Analysis

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each BARCT rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. Cost effectiveness will depend on the current level of controls, unit size, fuel usage and final emission levels. Details of the cost effectiveness analysis is contained in Appendix C to this report.

C. Socioeconomic Analysis

State law requires the District to analyze the socioeconomic impacts of any proposed rule or rule amendment that significantly affects air quality or strengthens an emission limitation. The socioeconomic analysis has been used to further refine the rule amendments. The final socioeconomic report is attached to this staff report as Appendix D.

D. Environmental Impact Analysis

The District is proposing to amend existing District Rule 4702. The purpose of this rule amendment project includes lowering the NOx and VOC emission limits for specific classes and categories of IC engines, in order to meet commitments made to the *2018 PM2.5 Plan*.

There are no other actions or rule requirements associated with this project. Based on the District's review, substantial evidence supports the District's conclusion that the

amendments will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and as such is not a "project" as that term is defined under the California Environmental Quality Act (CEQA) Guidelines § 15378. In addition, substantial evidence supports the District's conclusion that, if one assumes the amendment is a "project" under CEQA in spite of our conclusion to the contrary, it will not have any significant adverse effects on the environment.

In addition, the amendments to District Rule 4702 is an action taken by a regulatory agency, the San Joaquin Valley Air District, as authorized by state law to assure the maintenance, restoration, enhancement, or protection of air quality in the San Joaquin Valley where the regulatory process involves procedures for protection of air quality.

California Environmental Quality Act (CEQA) Guidelines §15308 (Actions by Regulatory Agencies for Protection of the Environment), provides a categorical exemption for "actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption." No construction activities or relaxation of standards are included in this project. Therefore, the rule amendment project is exempt from CEQA.

Finally, according to Section 15061 (b)(3) of the CEQA Guidelines, a project is exempt from CEQA if, "(t)he activity is covered by the common sense exemption that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." As such, for this additional reason, the District finds that the rule amendment project is exempt from CEQA.

E. Rule Consistency Analysis

Pursuant to CH&SC §40727.2, prior to adopting, amending, or repealing a rule or regulation, the District is required to perform a written analysis that identifies and compares the air pollution control elements of the rule or regulation with corresponding elements of existing or proposed District and EPA rules, regulations, and guidelines that apply to the same source category. District staff has concluded that the proposed rules are not in conflict with nor inconsistent with other District rules, nor are the proposed rules in conflict with nor inconsistent with federal policy, rule, or regulations governing the same source category. The analysis is discussed further in Appendix E of this staff report.

F. Reasonably Available Control Technology (RACT) and Best Available Retrofit Control Technology (BARCT) Analyses

Sections 182(b)(2) and 182(f) of the federal Clean Air Act require ozone nonattainment areas to implement RACT for sources that are subject to Control Techniques Guidelines (CTG) documents issued by EPA and for "major sources" of VOCs and NOx, which are ozone precursors. RACT can be defined as devices, systems, process modifications, or other apparatus or techniques that are reasonably available, taking into account the necessity of imposing such controls in order to attain and maintain a national ambient air quality standard (NAAQS); the social, environmental, and economic impact of such controls; and alternative means of providing for attainment and maintenance of such a standard. These control techniques, which are defined in EPA guidelines for limiting emissions from existing sources in nonattainment areas, are adopted and implemented for nonattainment areas by state analysis.

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617),[4] Non-vehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. One requirement of AB 617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements. Most existing stationary sources in non-attainment areas such as the San Joaquin Valley have been subject to Best Available Retrofit Control Technology (BARCT) requirements since the 1980s. California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

"Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source."

Appendix F of this report evaluates the requirements of Proposed Rule 4702 in light of the previous definitions of RACT and BARCT.

[4] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

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APPENDIX A

Summary of Significant Comments and District Responses For Proposed Amendments to Rule 4702

August 19, 2021

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SUMMARY OF SIGNIFICANT COMMENTS FOR PROPOSED AMENDMENTS TO RULE 4702 (INTERNAL COMBUSTION ENGINES) DATED AUGUST 19, 2021

STAKEHOLDER COMMENTS:
Roger Isom, Western Agricultural Processors Association (WAPA)
Colby Morrow, Southern California Gas Company (SoCal Gas)
William Shaffer, California Resources Corporation (CRC)
Kathleen Beresh, Energy Systems (ES)
Cynthia Pinto-Cabrera, Central Valley Air Quality Coalition (CVAQ)

1. **Comment:** What factors were considered for the cost effectiveness analysis for Ag engines? (WAPA)

   Response: Absolute cost effectiveness of a control option is the added annual cost, in dollars per year, of a control technology or technique divided by the emission reductions achieved, in tons reduced per year. Cost effectiveness was calculated using both one-time costs and on-going annual costs, to determine an annual cost based off a 10-year equipment life. Once determined the annual cost was then divided by the emission reductions to determine the cost effectiveness on an engine by engine, category, and entire rule bases. Costs were submitted to the District for a certain size of engine. In order to determine the costs for engines with different outputs, cost scaling was calculated based on engine size. In order to calculate the emission reductions for agricultural rich-burn and lean-burn engines an annual operation hours value of 1800 and a load factor of 0.8 were used. A detailed breakdown of the calculations and cost effectiveness values for each engine category can be found in Appendix C.

2. **Comment:** Why are the proposed limits going below the limits referenced in the *2018 PM2.5 Plan*? (SoCal Gas)

   Response: The District is dedicated to protecting public health for all residents in the San Joaquin Valley through efforts to meet health-based state and federal ambient air quality standards. Despite the significant progress under these regulations many air quality challenges remain, including attainment of the federal air quality standards for fine particles less than 2.5 micrometers in diameter (PM2.5), as addressed in the District's *2018 PM2.5 Plan*. One of the measures included in the *2018 PM2.5 Plan* is to amend Rule 4702 as a necessary cost-effective measure for further reducing NOx emissions, and bringing the Valley into attainment with federal PM2.5 standards within the mandated federal deadlines. This rule amendment project is proposed to satisfy the commitments in the District's *2018 PM2.5 Plan*, and to ensure that Rule 4702 requires the implementation of state and federal standards of Reasonably Available Control Technology (RACT), Best Available Retrofit Control

Technology (BARCT), and Most Stringent Measures (MSM). The Plan included an aggregate commitment of NOx reductions from multiple rules and strategies, with amendments to Rule 4702 being a part of the total emissions reductions the District committed to achieving. Through extensive control technology based research and cost analysis the District has determined that the proposed limits are the most cost effective and technologically feasible at this time. A description of potential control technologies and the cost associated can be found in the body of the staff report and Appendix C respectively.

3. **Comment:** Please elaborate upon the District's review and consideration of the percent reduction demonstration compliance option. (CRC)

   Response: Percent reduction was provided as an option in previous versions of the rule in order to allow for engines, which could not be retrofit to meet the emissions limits, to still operate at a cleaner level. There are currently 22 engines at two oil and gas facilities that currently use the percent reduction option. Due to the high level of reduction in the current version of the rule, between 70-93% depending on engine category, continuing to allow for compliance based on percent reduction would not produce significant emissions reductions. It is the District's goal in this rule amendment process to draft a rule that will contribute towards the Valley's attainment of the health-based federal PM2.5 and ozone standards, and satisfy the commitments in the *2018 PM2.5 Plan.* It has been determined by District staff that all of the engines in the Valley inventory can meet the proposed limits through tuning, retrofit with a NSCR, conversion, or replacement, and that these requirements achieve cost-effective emission reductions. For these reasons, the proposed limits in the Rule 4702 amendment do not include percent reduction options.

4. **Comment:** Is the District proposing to require Tier 4 for all engines greater than 50 bhp? (ES)

   Response: The District is not proposing any changes to the limits/standards for compression ignited engines at this time. The current rule requires that all newly installed engines be the cleanest certified engine available at the time of installation. Additionally, the requirements in Rule 4702 also specify that, upon engine replacement, an operator must install the cleanest certified engine available. Due to the stringency of these requirements, District staff are not proposing to amend limits for CI engines at this time. Emission limits for CI engines may be further evaluated as a part of future rule development efforts. New and modified engines that are subject to BACT may be required to comply with more stringent emission limits.

5. **Comment:** The District should implement the amendments to remove emissions fee compliance option for all engine categories immediately upon approval, as

opposed to the currently proposed sunset date for this compliance option of December 31, 2023. (CVAQ)

Response: The District is proposing the sunset date of December 31, 2023, in order to provide time for facilities which are currently using the fee payment option to come into compliance. The proposed compliance date for the sunset of the fee payment compliance option is in line with the earliest proposed emissions limit compliance date, which will allow operators time to transition their existing equipment to comply with the proposed emissions limits that take effect in 2024.

6. **Comment:** The District should continue examining electrification opportunities and require electrification at feasible locations. (CVAQ)

Response: District staff conducted a full analysis of the potential for electrification in the Valley. The required installation and operation of an electric motor would be considered an infeasible requirement due to conditions such as the lack of infrastructure and space, as well as the high cost of electricity and increasing rate fees. The cost-effectiveness associated with requiring the installation and maintenance of electric motors could be up to $260,000 per ton of emissions reduced for each unit installed. The District continues to promote the use of electric motors with the incentive funding grant which covers up to 85% of the cost to install an electric motor. A discussion of potential control technologies and associated costs can be found in the body of the staff report Section II Part A “Emission Control Technologies”.

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APPENDIX B

Emission Reduction Analysis
For Proposed Amendments to Rule 4702

August 19, 2021

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I. SUMMARY

The purpose of this rule project is to obtain as much reductions of nitrogen oxides (NOx) and Volatile Organic Compounds (VOC) emission from the source category as expeditiously practical, technologically feasible, and economically reasonable. The District committed to amending Rule 4702 as part of the *2018 PM2.5 Plan*. This appendix details the calculations and assumptions used to estimate the NOx and VOC emission reductions associated with the proposed amendments to Rule 4702.

Emission reductions were estimated using permit conditions of each individual affected engine and the proposed rule's emission limits. Table 1 shows the percent emission reductions estimated to be achieved from the baseline emissions for spark-ignited engines, and the number of engines that would be affected in each rule category.

Table 1 – Summary of NOx and VOC Percent Reductions from Spark-Ignited Engines

Affected Engine Category	Total Engines	Affected Engines	Total Rated Power (bhp)	NOx Reduction	VOC Reduction	Year
Rich-Burn	223	78	148,539	8%	39%	2024
Lean-Burn	69	42	137,281	48%	83%	2024
AO Lean-Burn	150	115	45,141	56%	81%	2030
AO Rich-Burn	364	359	80,290	87%	62%	2024
Total	806	594	411,255	48%	76%	2030

II. BACKGROUND

There are two types of spark-ignited engines that would be affected by the proposed rule changes: rich-burn and lean-burn engines. District staff estimates that there are 223 rich-burn engines and 69 lean-burn non-emergency-standby engines that are currently under permit with the District and are subject to Rule 4702. There are an additional estimated 364 rich-burn and 150 lean-burn engines that are used at agricultural operations within the District.

As further detailed earlier in this staff report, effective NOx emission control equipment for rich-burn engines includes non-selective catalytic reduction systems (NSCR). For lean-burn engines, the most common NOx emission control equipment is selective catalytic reduction (SCR). Both control systems require catalysts to convert NOx to nitrogen gas. NSCR tends to be less expensive to install and operate than a SCR system, but requires high temperature at the engine's outlet in order to be effective. NSCR is usually installed on rich-burn engines, and SCR is a control that is only able to be utilized for lean-burn engines.

Currently, the District does not take State Implementation Plan (SIP) credit for emissions reductions achieved through fee payment programs and related monetary incentive programs. However, as the fee payment program within this rule is proposed to sunset in 2023, the District will be proposing to take SIP credit for the emission reductions estimated to be achieved through this rule amendment.

III. EMISSION REDUCTION ANALYSIS

It is the District's experience that, when an emission limit is reduced, a small percentage of operators will choose to replace their internal combustion (IC) engines with electric motors, rather than retrofit with an emission control system. It would be speculative, at best, to determine which engines may be electrified as a result of this rule amendment, therefore the following emission reduction analysis does not include any estimate of NOx reductions for electrification. District staff will be quantifying the emissions achieved through the existing District Ag Pump Replacement incentive program in a separate reporting effort.

A. Affected Engines

District staff queried the Permit Services Permits Database for spark-ignited engines. The returned records were then sorted into one of three groups: emergency standby/dormant engines; rich-burn engines; and lean-burn engines. The emergency standby engines and dormant engines were removed from the analysis. The information about the remaining engines' facility and the permit information were scrutinized to estimate which engines would fit into one of six categories: limited-use, cyclic-loaded field gas fueled, waste gas fueled, two-stroke gaseous fueled greater than 50 brake horsepower (bhp) and less than 100 bhp, gas compression, or not listed above engine definitions. The number of affected engines and estimated emissions reductions from the potential to emit baseline for each rule category are shown in the table below.

Table 2 – Summary of NOx and VOC Emissions Reductions

Affected Engine Category	Number Affected Engines	Total Rated Power (bhp)	Estimated NOx Reductions (tpy)	Estimated VOC Reductions (tpy)
Rich-Burn	78	43,112	13.4	194.2
Lean-Burn	42	85,211	500.3	2118.5
AO Lean-Burn	115	31,407	86.8	115.3
AO Rich-Burn	359	79,217	133.5	82.9
Total	594	238,947	734.0	2510.9

B. Emission Reduction Calculation Methodology

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., pounds of NOx emitted per hour). Such factors facilitate estimation of emissions from various sources of air pollution. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category (i.e., a population average).

The general equation for emissions estimation is[1]:

$$E = A \times EF \times (1 - \frac{ER}{100}) \quad (1)$$

Where:

E = emissions;
A = activity rate;
EF = emissions factor; and
ER = overall emission reduction efficiency, %.

In order to use Equation 1 to estimate the emissions for the proposed revisions to Rule 4702, District staff prepared emissions factors for permitted engines in pounds of pollutant per hour of operation for both NOx and VOC. Rule and permit limits for engines are expressed in parts per million by volume (ppmv) and required conversion. To start, District staff applied EPA Method 19[2] to convert from ppmv to lb/MMBtu, as follows:

$$E_h = C_d F_d \frac{20.9}{20.9 - \%O_{2d}} \quad (2)$$

Where:

E_h = Emissions per heat content of fuel, in lb/MMBtu
C_d = Pollutant concentration, dry basis in lb/scf;
F_d = Volume of combustion components per unit of heat content in scf/MMBtu;
$\%O_{2d}$ = Concentration of oxygen on a dry basis, in percent.

Default values for F_d are provided by EPA Method 19, for natural gas, propane, or butane the value is 8,710 scf/MMBtu determined at standard conditions including a temperature of 68ºF. However, the District uses standard temperature of 60ºF, so that value must be converted resulting in 8,578 scf/MMBtu. Rule 4702 uses a standard

[1] https://www.epa.gov/air-emissions-factors-and-quantification/basic-information-air-emissions-factors-and-quantification
[2] https://www.epa.gov/sites/production/files/2017-08/documents/method_19.pdf

oxygen concentration ($\%O_{2d}$) value of 15%. Pollutant concentration (C_d) is converted from ppmv as measured to lb/scf for this calculation. To accomplish this conversion, staff used the following equation:

$$C_d = \frac{ppmv}{10^6} \times \frac{PMM}{StdVol} \quad (3)$$

Where:

Cd = Pollutant concentration, per Equation 2;
ppmv = The permitted concentration limit of pollutant corrected to 15% O_2;
PMM = The pollutant molecular mass, in lb/lb-mol;
StdVol = The standard volume of a lb-mol of gas in scf/lb-mol.

Concentration limits were obtained from engine permits. Pollutant molecular mass for NOx was taken as 46 lb/lb-mol as NO_2, and for VOC is 16 lb/lb-mol as CH_4. Standard volume of a lb-mol of gas at District standard temperature is 379.5 scf/lb-mol.

The output of Equation 2 is in lb/MMBtu of fuel. To prepare a value that can be scaled to engine size and hours of operation staff converted to pounds per break horsepower hour (lb/bhp-hr) requiring an engine efficiency and unit conversion constants, as follows:

$$E_w = \frac{E_h}{Eff} \times \left(\frac{1\ MMBtu}{10^6\ Btu}\right) \times \left(\frac{2{,}545\ Btu}{1\ bhp{-}hr}\right) \quad (4)$$

Where:

E_w = Emissions per unit work, in lb/bhp-hr;
E_h = Emissions per heat content of fuel, in lb/MMBtu from Equation 2;
Eff = Engine efficiency, a unitless number.

A typical internal combustion engine efficiency, used for these calculations is 0.3 or 30%.

To determine the emissions factor to use in Equation 1, individual engine ratings in hp are used with a load factor based on the application, as follows:

$$EF = E_w \times P \times LF \quad (5)$$

Where:

EF = Emissions factor, in lb/hr;
E_w = Emissions per unit work, in lb/bhp-hr from Equation 4;
P = Engine rated power, in bhp;
LF = Load factor, a unitless number.

The load factor for 0.8 or 80% for agricultural engines, and 1.0 or 100% for all other engines.

Finally, the overall emission reduction efficiency (ER in Equation 1) is based on the percent reduction from the permit limit to the proposed rule limit. Calculated as follows:

$$ER = \frac{PL-RL}{PL} \quad (6)$$

Where:

ER = overall emission reduction efficiency, %.
PL = Permit limit, in ppmv @ 15% O2
RL = Proposed Rule 4702 Limit, in ppmv @ 15% O2

Activity for permitted engines was taken to be 4,000 hr/yr for non-agricultural limited use engines, 8,760 hr/yr for other non-agricultural engines, and 1,800 hr/yr for agricultural engines.

Example NOx Calculation

Bhp rating = 191 bhp
Permit Limit for NOx = 25 ppmv @ 15% O2
Proposed Limit for NOx = 11 ppmv @ 15% O2
Annual Hours of Operation: 4,000 hour/yr

Starting with Equation 3:

$$C_d = \frac{25}{10^6} \times \frac{46\ {}^{lb}/_{lb-mol}}{379.5\ {}^{scf}/_{lb-mol}} = 3.03 \times 10^{-6}\ {}^{lb}/_{scf} \quad (7)$$

Then applying Equation 2:

$$E_h = 3.03 \times 10^{-6}\ {}^{lb}/_{scf} \times 8{,}578\ {}^{scf}/_{MMBtu} \times \frac{20.9}{20.9-15} = 0.0921\ {}^{lb}/_{MMBtu} \quad (8)$$

Then applying Equation 4:

$$E_w = \frac{0.0921\ {}^{lb}/_{MMBtu}}{0.3} \times \left(\frac{1\ MMBtu}{10^6\ Btu}\right) \times \left(\frac{2{,}545\ Btu}{1\ bhp-hr}\right) = 0.000781\ {}^{lb}/_{bhp-hr} \quad (9)$$

Then applying Equation 5:

$$EF = 0.000781\ {}^{lb}/_{bhp-hr} \times 191\ bhp \times 1 = 0.149\ {}^{lb}/_{hr} \quad (10)$$

Determining the emission reduction efficiency using Equation 6:

$$ER = \frac{25\ ppmv - 11\ ppmv}{25\ ppmv} = 0.56 = 56\% \quad (11)$$

Finally, applying Equation 1:

$$E = 4{,}000\ hr \times 0.149\ {}^{lb}/_{hr} \times \left(1 - \frac{56}{100}\right) = 262.59\ {}^{lb}/_{yr} \quad (12)$$

Thus, the estimated annual emissions for this example engine after complying with proposed new limits of the proposed amendments to Rule 4702 would be 262.59 lb/yr NOx, or 0.131 tpy NOx. Subtracting this from the same calculation with no reductions from Equation 6 would provide the emissions reduction estimate for this engine.

These calculations were performed for every permitted engine expected to be affected by the proposed Rule 4702. Detailed results of these calculations can be found Table 8 at the end of this Appendix.

C. SIP Credit from Proposed Rule

The emissions reductions calculated above are based on the potential to emit for permitted engines in the Valley, and were used in cost-effectiveness calculations in Appendix C. However, in order to determine the emissions reductions that may be applied to commitments in the SIP, the reductions must be normalized to the planning inventory used in the analysis for the *2018 PM2.5 Plan*. The *2018 PM2.5 Plan* inventory for Engines from CEPAM v. 1.05 is shown in Table 3.

Table 3 – Annual Average Emissions Inventory from Engines (tpd)

Pollutant	2020	2022	2023	2024	2025	2026	2028	2029	2030
NOx	6.18	5.72	5.52	5.34	5.16	5.00	4.67	4.51	4.36
VOC	0.80	0.75	0.73	0.71	0.69	0.67	0.64	0.63	0.61

The emissions reduction calculations performed in this analysis focus on spark ignited engines subject to more stringent emissions requirements in the proposed amendment. As a result, normalizing the emissions reductions should be based only on the portion of the inventory specific to spark ignited engines. The emissions inventory is divided into categories based on source type, fuel, and other factors with each category represented by an emissions inventory code (EIC). Overall, Rule 4702 affects 28 EICs and of those only 15 are spark ignited engines. Table 4 lists the EICs that represent spark ignited internal combustion engines.

Table 4 – List of EICs for Spark Ignited Engines

EIC	EIC Summary
010- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
020- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
030- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
030- 040- 0124- 0000	Reciprocating Engines Fueled By Propane

EIC	EIC Summary
040- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
050- 040- 0012- 0000	Reciprocating Engines with Unspecified Fuel
050- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
050- 040- 0124- 0000	Reciprocating Engines Fueled By Propane
052- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
052- 042- 0110- 0000	AG. Irrigation I. C. Engines Fueled By Natural Gas
060- 040- 0110- 0000	Reciprocating Engines Fueled By Natural Gas
060- 040- 0124- 0000	Reciprocating Engines Fueled By Propane
060- 040- 0142- 0000	Reciprocating Engines Fueled By Landfill Gas
060- 040- 0146- 0000	Reciprocating Engines Fueled By Digester Gas
060- 040- 1100- 0000	Reciprocating Engines Fueled By Unspecified Gasoline

The total emissions from the EICs are provided in Table 5.

Table 5 – Annual Average Emissions Inventory from Spark Ignited Engines (tpd)

Pollutant	2020	2022	2023	2024	2025	2026	2028	2029	2030
NOx	1.51	1.48	1.47	1.45	1.43	1.41	1.39	1.38	1.37
VOC	0.46	0.44	0.44	0.43	0.42	0.42	0.41	0.40	0.40

To normalize the calculated emissions reductions to the *2018 PM2.5 Plan* inventory, the total potential emissions without reductions was calculated to determine the emissions reductions from affected engines as a percentage of the category. These percentages are shown in Table 6.

Table 6 – Percent Emissions Reductions by Year

Pollutant	2024—2029	2030 and Later
NOx	44%	50%
VOC	72%	75%

To determine the emissions reductions achieved for SIP purposes, District staff multiplied the percent reductions by the spark ignited inventory included in CEPAM version 1.05 (the inventory used for the *2018 PM2.5 Plan*). Emission reductions from spark ignited engines for the proposed amendments are shown in Table 7.

Table 7 – Emissions Reductions from Proposed Amendment in Implementation Years (tpd)

Pollutant	2024	2030
NOx	0.62	0.70
VOC	0.31	0.32

Table 8- Estimated NOx and VOC Reductions from Proposed Amendments

Engine Category	Current NOx Permit Limit (ppmv)	Current VOC Permit Limit (ppmv)	Number of Units	Sum of Engine Power (bhp)	Proposed NOx Limit (ppmv)	Proposed VOC Limit (ppmv)	Sum of NOx Reductions (tpy)	Sum of VOC Reductions (tpy)
RB Cyclic Loaded, Field Gas Fueled	50	250	7	1101	11	90	5.88	8.39
RB Limited Use	25	250	18	7887	11	90	6.9	7.3
RB Not Listed Above	5	30	55	68064	11	90	0	0
	5.8	14	1	460	11	90	0	0
	6	25	1	539	11	90	0	0
	9	350	32	8179	11	90	0	9.13
	10.4	125	4	3360	11	90	0	1.4
	11	350	99	56698	11	90	0	167.95
	25	30	1	330	11	90	0.63	0
LB Gas Compression	11.9	34.1	4	17780	40	90	0	0
	64	212	3	978	40	90	3.21	5.68
	65	750	8	9755	40	90	33.38	195.87
	75	355	2	2000	40	90	9.58	25.23
	83	710	6	30000	40	90	176.55	885.41
	86	355	1	1000	40	90	6.3	12.61
	88	710	3	6000	40	90	39.41	177.08
	90	750	1	1000	40	90	6.84	31.42
	95	710	3	15000	40	90	112.91	442.7
	101	710	3	6000	40	90	50.09	177.08

Engine Category	Current NOx Permit Limit (ppmv)	Current VOC Permit Limit (ppmv)	Number of Units	Sum of Engine Power (bhp)	Proposed NOx Limit (ppmv)	Proposed VOC Limit (ppmv)	Sum of NOx Reductions (tpy)	Sum of VOC Reductions (tpy)
	104	750	3	4000	40	90	35.04	79.83
LB Waste Gas	10	20	4	12048	40	90	0	0
	43	51	1	1175	40	90	0.48	0
	50	57	1	892	40	90	1.22	0
	64	122	1	577	40	90	1.9	0.88
	65	750	6	6834	40	90	23.38	84.73
LB Not Listed Above	5	25	1	1737	11	90	0	0
	9	48	4	7667	11	90	0	0
	10	24	3	3736	11	90	0	0
	11	21	8	8002	11	90	0	0
AO Rich-Burn	2.8	6	1	398	11	90	0	0
	14.1	2	5	1010	11	90	0.07	0
	14.8	2	1	202	11	90	0.02	0
	19.8	4	4	500	11	90	0.1	0
	20	30	1	380	11	90	0.08	0
	20.1	3	1	200	11	90	0.04	0
	30	25	8	1770	11	90	0.76	0
	31	4	1	159	11	90	0.07	0
	36	5	1	173	11	90	0.1	0
	38	79	1	250	11	90	0.15	0
	40.9	6	1	174	11	90	0.12	0
	42	7	1	129	11	90	0.09	0
	70	138	1	151	11	90	0.2	0.06

Engine Category	Current NOx Permit Limit (ppmv)	Current VOC Permit Limit (ppmv)	Number of Units	Sum of Engine Power (bhp)	Proposed NOx Limit (ppmv)	Proposed VOC Limit (ppmv)	Sum of NOx Reductions (tpy)	Sum of VOC Reductions (tpy)
	90	750	333	74119	11	90	131.73	82.83
AO Lean-Burn	33	21	2	644	11	90	0	0
	38	2	2	644	11	90	0	0
	39	17	1	322	11	90	0	0
	40	7	1	322	11	90	0	0
	42.3	6	14	4503	11	90	0	0
	43	6	10	3220	11	90	0	0
	50	16	1	240	11	90	0.21	0
	50.2	6	1	241	11	90	0.21	0
	74	70	1	449	11	90	0.64	0
	79	50	1	322	11	90	0.49	0
	83.6	50	9	4497	11	90	7.34	0
	90	750	7	1563	11	90	2.77	3.33
	150	750	88	22085	11	90	69.06	108.68
AO Lean-Burn Digester Engine	10	24	1	1215	43	90	0	0
	11	21	1	1057	43	90	0	0
	150	87	2	400	43	90	5.86	0
AO Lean-Burn Permit Mod	49.4	750	2	644	43	90	0.09	3.33
	50	7	3	966	43	90	0.15	0

Engine Category	Current NOx Permit Limit (ppmv)	Current VOC Permit Limit (ppmv)	Number of Units	Sum of Engine Power (bhp)	Proposed NOx Limit (ppmv)	Proposed VOC Limit (ppmv)	Sum of NOx Reductions (tpy)	Sum of VOC Reductions (tpy)
Dormant AO Lean-Burn Digester Engine	0	0	3	1811	0	90	0	0
Dormant AO Rich-Burn	0	0	4	675	0	90	0	0
Dormant LB Not Listed Above	0	0	3	1100	0	90	0	0
Dormant RB Not Listed Above	0	0	5	1921	0	90	0	0
Grand Total							734.05	2510.92

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APPENDIX C

Cost Effectiveness Analysis
For Proposed Amendments to Rule 4702

August 19, 2021

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COST EFFECTIVENESS ANALYSIS FOR PROPOSED RULE 4702

I. SUMMARY

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each Best Available Retrofit Control Technology (BARCT) rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule.

Absolute cost effectiveness of a control option is the added annual compliance cost to meet the proposed rule's requirements, in dollars per year, divided by the emission reduction achieved in tons of pollutant reduced per year.

Table 1 shows the costs and the results of the cost effectiveness analysis for engines in the District inventory that are greater than 50 bhp, and that would have annualized costs and emissions reductions due to the proposed rule amendment. District staff estimates that operators will need to retrofit, replace, or update a permit for a total of 594 engines to comply with the emissions limits proposed in Rule 4702. Costs and emission reduction calculations for engines that may need to be replaced is based on the assumption that they will be replaced at the end of their useful life. Additionally, for engines that are currently source testing below the proposed limits, a capital cost of $2,000 was allocated for the high end potential cost associated with a required permit amendment. It is due to this estimated permitting fee that the cost effectiveness values for AO Rich Burn engines 14 ppmv and 20 ppmv range from $0 to up to approximately $23,000-$26,000.

Table 1 - Summary of Compliance Costs and Cost Effectiveness

Compliance Scenario (Current Permitted Limit to Proposed New Limit)	Expected Cost-Effectiveness Per Engine ($/ton)	Cost Effectiveness Range ($/ton)
AO Lean-Burn		
Replace Engine 50 ppmv to 11 ppmv	$13,120	$10,257 - $15,989
Replace Engine 70 ppmv to 11 ppmv	$3,426	$3,426
Replace Engine 80 ppmv to 11 ppmv	$4,753	$2,199 - $6,894
Replace Engine 150 ppmv to 11 ppmv	$2,526	$1,143 - $4,607
Convert to Rich Burn 90 ppmv to 11 ppmv	$21,857	$18,088 - $25,682
Convert to Rich Burn 150 ppmv to 11 ppmv	$9,013	$4,297 - $18,474
Replace & Upgrade NSCR 90 ppmv to 11 ppmv	$5,336	$5,282 - $5,390

Compliance Scenario (Current Permitted Limit to Proposed New Limit)	Expected Cost-Effectiveness Per Engine ($/ton)	Cost Effectiveness Range ($/ton)
AO Rich-Burn		
Upgrade/Replace NSCR 14 ppmv to 11 ppmv	$20,890	$0 - $23,030
Upgrade/Replace NSCR 20 ppmv to 11 ppmv	$8,764	$0 - $26,573
Upgrade/Replace NSCR 30 ppmv to 11 ppmv	$18,321	$4,550 - $37,515
Upgrade/Replace NSCR 40 ppmv to 11 ppmv	$11,250	$2,781 - $20,193
Upgrade/Replace NSCR 70 ppmv to 11 ppmv	$5,394	$1,624 - $9,164
Upgrade/Replace NSCR 90 ppmv to 11 ppmv	$5,643	$603 - $16,470
LB Gas Compression		
Low-Emission Combustion System 60 ppmv to 40 ppmv	$1,206	$48 - $2,405
Low-Emission Combustion System 80 ppmv to 40 ppmv	$658	$10 - $1,312
Low-Emission Combustion System 90 ppmv to 40 ppmv	$462	$25 - $998
Low-Emission Combustion System 100 ppmv to 40 ppmv	$363	$8 - $706
LB Waste Gas		
Low-Emission Combustion System 41-49 ppmv to 40 ppmv	$5,972	$675 - $11,269
Low-Emission Combustion System 50 ppmv to 40 ppmv	$3,630	$267 - $6,993
Low-Emission Combustion System 60 ppmv to 40 ppmv	$1,800	$68 - $3,518
RB Cyclic Loaded, Field Gas Fueled		
Upgrade/Replace NSCR 50 ppmv to 11 ppmv	$879	$313 - $1,530
RB Limited Use		
Upgrade/Replace NSCR 30 ppmv to11 ppmv	$5,063	$252 - $12,700
RB Not Listed Above		
Upgrade/Replace NSCR 30 ppmv to 11 ppmv	$1,269	$515 - $2,023

Permit Limits organized and grouped to the nearest 10

II. BACKGROUND

Revised Proposed Rule 4702 would implement more stringent NOx and VOC limits for spark-ignited engines greater than 50 bhp. The majority of these engines are operated on natural gas. It is the District's experience that, when an emission limit is reduced, a small percentage of operators will choose to replace their IC engines with electric

motors rather than retrofit with an emission control system. It would be speculative, at best, to determine which engines would become electrified; therefore the following compliance costs and cost effectiveness analysis do not include any cost-of-electrification scenarios.

For rich-burn engines, non-selective catalytic reduction (NSCR) is the most likely retrofit control technology. Most rich-burn engines already have NSCR and the majority of those can already achieve the proposed NOx limit. The engines that currently do not meet the proposed NOx limit would have to either install a new NSCR system or upgrade their existing NSCR systems and add more catalyst, or possibly replace the engine and NSCR system in order to meet the proposed NOx limit.

For lean-burn engines, there are no cost effective retrofits available, and as such all affected engines would either need to be replaced or tuned in order to meet the proposed limits. All lean-burn engines that would be required to limit their emissions to 11 ppmv are already source testing below that limit, and would not require the installation of a new selective catalytic reduction (SCR) system. All other existing engines are either meeting the proposed limits or should be able to do so with minor adjustments or upgrades, such as new air/fuel ratio controllers and O2 sensors. The costs used for this analysis assume that the operator would not have to install an SCR system. Additionally, for lean-burn AO engines that were previously rich-burn or would need to be replaced within the next 10 years, it is assumed that by 2030 the engine would be converted/replaced with a rich-burn engine. Calculations for costs and emissions reductions reflect that assumption. For the lean-burn engines that were assumed to be replaced with rich-burn engines, an additional operations and maintenance cost was added to reflect the maintenance of catalysts and potential increase of fuel usage. This increased operation and maintenance cost was not included for engines that were assumed to remain as lean-burn.

A. Estimated Compliance Cost

District staff used cost information provided by control equipment manufacturers and vendors, and from stakeholders to conduct a cost effectiveness analysis of the proposed NOx limits in Draft Rule 4702. The data used in the analysis came from the following sources:

1. Agricultural engine stakeholder(s)
2. MIRATECH Corporation
3. MurCal, Inc.
4. Pennsylvania Department of Environmental Protection, Bureau of Air Quality Technical Support Document For the General Plan Approval and/or General Operating Permit for Unconventional Natural Gas Well Site Operations and Remote Pigging Stations (BAQ-GPA/GP-5A, 2700-PM-BAQ0268) And the Revisions to the General Plan Approval and/or General Operating Permit for Natural Gas Compressor Stations,

Processing Plants, and Transmission Stations (BAQ-GPA/GP-5, 2700-PM-BAQ0267) (Final June 2018)
5. Quinn Company
6. TGP West
7. Valley Power Systems

Generally, OAQPS methodologies were used to estimate installation costs and, in some cases, annual operation and maintenance costs. Cost information provided to the District or estimated by the information provided is summarized in Table 2.

Table 2 - Estimated Capital Cost for Control Technology by Engine Size

Category	Size (bhp)	Estimated Installation Cost
NSCR for RB IC Engine	200	$4,671
NSCR for RB IC Engine	200	$5,418
NSCR for RB IC Engine	250	$6,291
NSCR for RB IC Engine	250	$8,406
NSCR for RB IC Engine	250	$8,856
NSCR for RB IC Engine	250	$11,313
NSCR for RB IC Engine	256	$6,291
NSCR for RB IC Engine	256	$9,252
NSCR for RB IC Engine	256	$12,680
NSCR for RB IC Engine	685	$9,840
NSCR for RB IC Engine	1,320	$13,382
SCR for LB IC Engine	1,320	$147,600
SCR for LB IC Engine for Oil and Gas Operations	450	$167,300
SCR for LB IC Engine for Oil and Gas Operations	1,000	$196,800
SCR for LB IC Engine for Oil and Gas Operations	1,000	$263,860
SCR for LB IC Engine for Oil and Gas Operations	1,200	$216,480
SCR for LB IC Engine for Oil and Gas Operations	1,200	$276,730
SCR for LB IC Engine for Oil and Gas Operations	1,500	$236,160
SCR for LB IC Engine for Oil and Gas Operations	1,500	$296,030
SCR for LB IC Engine for Oil and Gas Operations	2,000	$236,160
SCR for LB IC Engine for Oil and Gas Operations	2,000	$328,200
SCR for LB IC Engine for Oil and Gas Operations	4,000	$314,880
SCR for LB IC Engine for Oil and Gas Operations	4,000	$456,900
SCR for LB IC Engine for Oil and Gas Operations	5,500	$373,920
SCR for LB IC Engine for Oil and Gas Operations	5,500	$553,420
New RB IC Engine with NSCR	175	$95,000
New LB IC Engine converted from RB	140	$47,522

Category	Size (bhp)	Estimated Installation Cost
New LB IC Engine converted from RB	200	$67,406
New LB IC Engine converted from RB	250	$86,053
New LB IC Engine	241	$86,400
New LB IC Engine	323	$85,000
New LB IC Engine	323	$95,800

III. Cost Effectiveness Analysis Procedure

To illustrate the cost effectiveness of complying with the proposed limits, District staff's analysis provides varying cost effectiveness values depending on the size of the unit, and the annual capacity factor that the unit is operated. The actual compliance costs and cost effectiveness values would depend on several factors such as the type of unit, site-specific operating conditions, and the appropriate emission limits the unit has to meet.

A. Absolute Cost Effectiveness (ACE) Calculation Method

The absolute cost effectiveness of a control technology is calculated as follows:

1. Determine an equivalent annual equipment cost using a capital recovery factor based on an assumed interest rate of 10 percent and equipment life of 10 years.
2. Determine the annual electricity, fuel, and operation and maintenance costs of a control technology.
3. Calculate the total annual cost by adding the costs calculated in Step 1 and Step 2.
4. Calculate the emission reduction in tons/year. Appendix B provides a detailed explanation of the calculations performed to determine the emission reductions for the potential rule limits.
5. Calculate the absolute cost effectiveness by dividing the total annual cost in Step 3 by the emissions reduction in Step 4.

B. Incremental Cost Effectiveness (ICE) Calculation Method

The incremental cost effectiveness of a control technology is calculated as follows:

1. Identify the complying control options appropriate for the existing equipment.
2. Estimate the annual average cost of each control option by using Steps 1 to 3 of the ACE calculation method.

3. Calculate the potential emission reduction for each control option. The potential emission reductions (PE) are the difference between the current emissions and the potential emissions using the new control technology.

IV. Absolute Cost Effectiveness

A. Retrofit of AO and Non-AO Spark-Ignited Engines

District staff queried the Permit Services Permits Database to compile a list of permitted engines, and the returned records were then manually sorted into one of three groups: emergency standby/dormant engines; rich-burn engines; and lean-burn engines. The emergency standby engines and dormant engines were removed from the analysis.

Compliance costs include both one-time costs and on-going annual costs. Examples of one-time costs are the purchase of equipment and installation costs. On-going costs are items like maintenance costs, reagent purchases, and the additional fuel burned because of the control technology (fuel penalty). In order to determine a single figure for costs, District staff use a capital recovery factor to allocate the one-time costs over the life of the equipment. For all cost analyses in this report, District staff used a 10 percent rate of return and a 10-year equipment life to convert the capital costs to equivalent annual cost.

Costs were submitted to the District for certain sizes of engines. In order to determine costs for engines with sizes different than those for which costs were submitted, District staff used a linear interpolation equation based on the size of the engine (bhp), and engine type. Each facility is unique and has its own challenges in adding new equipment, which can affect the cost of the equipment. With this in mind, District staff reviewed several sources of cost data. The lower cost may be more likely for smaller engines that need relatively simple modifications and the higher cost may reflect larger engines involving more extensive modifications.

1. Rich-Burn Engines

The District worked with numerous facilities, vendors, and manufacturers to determine the costs to retrofit and/or replace these engines. Costs were submitted to the District for certain sizes of engines. District staff assumed that the engines that are subject to the 11 ppmv NOx limit would have a NSCR system on the engine. Table 6 outlines the basis for estimating compliance costs.

Using the costs submitted by stakeholders and technology vendors, and using a linear equation to adjust for different sized engines District staff was able to determine the costs of amending the NOx and VOC limits. Engines in this category with emissions over the proposed limits of 11 ppmv NOx and 90 ppmv VOC would need to upgrade their NSCR system. For this type of modification, there would be no additional operation and maintenance costs. The cost-effectiveness of engines grouped by

engine size is presented in Table 3. Table 6 outlines the basis for estimating compliance costs.

Category Rich-Burn
Technology Needed to Achieve Proposed Rule Limit of 11 ppmv by **2024**:

- Tuning existing engines with NSCR, Retrofit engines with NSCR, or Replace with a new rich-burn engine
- Annual Hours for AO engines: 1,800
- Annual Hours for Non-AO engines: 8,760
- Load Factor for AO engines: 0.8
- Load Factor for Non-AO engines: 1.0

Table 3 - Cost-Effectiveness Analysis for Rich-Burn Engines

Engine Power (bhp)	Technology Needed	Capital Cost	O&M ($/yr)	Annualized Cost ($/yr)	Emission Reductions (tons/yr)	Cost-Effectiveness ($/ton NOx)
50	Upgrade/Replace NSCR	$6,100	$720	$1,700	0.09	$18,900
100	Upgrade/Replace NSCR	$7,000	$720	$1,900	0.17	$11,200
200	Upgrade/Replace NSCR	$7,300	$720	$1,900	0.35	$5,400
300	Upgrade/Replace NSCR	$7,600	$720	$2,000	0.51	$3,900
400	Upgrade/Replace NSCR	$8,000	$720	$2,000	0.70	$2,900
500	Upgrade/Replace NSCR	$8,500	$720	$2,100	0.90	$2,300
600	Upgrade/Replace NSCR	$9,100	$720	$2,200	1.08	$2,000
700	Upgrade/Replace NSCR	$9,600	$720	$2,300	1.26	$1,800

Capital Costs, Annualized Costs, & Cost Effectiveness rounded to the nearest $100

2. Lean-Burn Engines

The limits for the lean-burn engine categories were determined by current inventory, potential costs, and the NOx emissions associated with new lean-burn engines. As explained in Section II of the Rule 4702 Staff Report, the addition of an SCR system to lean-burn engines, or the replacement of engines with electrification and/or solar have been determined to not be cost effective control systems, and as such the proposed NOx limits were determined based on the emissions of a new lean-burn engine, and a low emission combustion system. A limit of 11 ppmv NOx is being proposed for the

lean-burn Not Listed Above category, as all Not Listed Above engines currently in the Districts inventory source test below 11 ppmv NOx and would not need to be retrofit with a new SCR system to meet the proposed limit. A NOx limit of 40 ppmv is being proposed for some lean-burn Non-AO engines as that is the lowest limit that can be reached by fine tuning the existing engines with a low emission combustion system. For agricultural lean-burn engines specific considerations were taken into account when determining the 43 ppmv NOx limit, such as the location and life span of the engines. As outlined in section IV F of the Rule 4702 Staff Report the proposed NOx and VOC limits represent RACT and BARCT.

When calculating the compliance costs for lean-burn engines, District staff assumed that the engines that are subject to the 40+ ppmv NOx and 90 ppmv VOC limits would currently have no SCR to control emissions and that through low-emission combustion technology, and engine tune-ups, the engines would be able to meet the limits without the installation of an SCR system. Some lean-burn engines would need to install an oxidation catalyst, and have additional operations and maintenance costs in order to meet the proposed 90 ppmv VOC limit. The variation in what control technology would be required, and the size of the engines results in a range of possible costs.

The majority of engines within the AO lean burn engine category are EPA-certified engines that were purchased in order to comply with the current rule emissions limits, and as such the District is proposing an extended compliance date for AO lean-burn engines to allow for the useful life of the equipment to be met. The capital cost associated with replacing the AO lean-burn engines by December 31st, 2023, would be between $119,000 and $209,000 per unit, with cost effectiveness values of up to $108,200 per ton of emissions reduced. A more cost-effective regulatory requirement is achieved through extending the compliance deadline by which these engines must meet the proposed limits. Under the proposed rule requirements, these engines would be subject to a compliance date of December 31, 2029, or 12 years after the date of installation of the unit. The cost effectiveness of the proposed requirements are outlined in Table 4 for affected engines of various sizes.

The estimated costs for each engine are based on initially reported costs from control technology vendors, equipment manufacturers, and facility operators. Reported costs were then scaled to the size of affected engines in the Valley inventory using a linear equation relating the installed cost to the size of the engine. District staff then used standard ratios to fill in other portions of a capital equipment project. Once the total capital cost was evaluated, a capital recovery factor was applied to convert this one-time expense into the equivalent annual costs. Annual operating costs were estimated based on information provided by vendors and any potential fuel penalty. The annualized capital cost and the annual operating costs were then added together for the total annual compliance cost. The cost-effectiveness of engines that would remain lean-burn and would require an emission combustion retrofit are grouped by engine size and presented in Table 5.

Category Non-AO Lean-Burn
Technology Needed to Achieve the Proposed Rule Limits of 11 or 40 ppmv by **2024**:

- Tuning existing engines with a low emission combustions retrofit, or Replace with rich-burn and retrofit with NSCR
- Annual Hours for Non-AO engines: 8,760
- Load Factor for Non-AO engines: 1.0

Category AO Lean-Burn
Technology Needed to Achieve Proposed Rule Limit of 43 ppmv by **2030**:

- Tuning existing engines with a low emission combustions retrofit, or Replace with rich-burn and retrofit with NSCR
- Annual Hours for AO engines: 1,800
- Load Factor for AO engines: 0.8

Table 4 - Cost-Effectiveness of Lean-Burn Engines Converted to Rich-Burn with NSCR or Replace Engine

Engine Power (bhp)	Technology Needed	Capital Cost ($)	O&M ($/yr)	Annualized Cost ($/yr)	NOx Emission Reduction (tons/yr)	Cost-Effectiveness ($/ton NOx)
50	Convert to Rich-Burn and Install NSCR	$9,600	$1,770	$3,300	0.14	$23,600
100	Convert to Rich-Burn and Install NSCR	$9,900	$2,180	$3,800	0.30	$12,700
200	Convert to Rich-Burn and Install NSCR	$10,400	$3,020	$4,700	0.62	$7,600
300	Convert to Rich-Burn and Install NSCR	$10,900	$3,850	$5,600	0.93	$6,000
400	Convert to Rich-Burn and Install NSCR	$11,500	$4,690	$6,600	1.24	$5,300
500	Convert to Rich-Burn and Install NSCR	$12,000	$5,520	$7,500	1.55	$4,800
600	Convert to Rich-Burn and Install NSCR	$12,600	$6,360	$8,400	1.86	$4,500
700	Convert to Rich-Burn and Install NSCR	$13,100	$7,190	$9,300	2.17	$4,300

Capital Costs, Annualized Costs, & Cost Effectiveness rounded to the nearest $100

Table 5 - Cost-Effectiveness of Lean-Burn Low Emission Combustion Retrofit

Engine Power (bhp)	Technology Needed	Capital Cost ($)	O&M ($/yr)	Annualized Cost ($/yr)	NOx Emission Reduction (tons/yr)	Cost-Effectiveness ($/ton)
300	Low-Emission Combustion	$22,400	-	$3,600	1.03	$3,500
500	Low-Emission Combustion	$32,600	-	$5,300	1.70	$3,100
1000	Low-Emission Combustion	$57,900	-	$9,400	3.40	$2,800
1500	Low-Emission Combustion	$81,200	-	$13,200	5.39	$2,400
2000	Low-Emission Combustion	$94,900	-	$15,400	8.74	$1,800
5500	Low-Emission Combustion	$190,800	-	$32,000	32.19	$1,000

Capital Costs, Annualized Costs, & Cost Effectiveness rounded to the nearest $100

V. ABSOLUTE COST EFFECTIVENESS ANALYSIS

Absolute cost effectiveness of a control option is the added annual cost, in dollars per year, of a control technology or technique divided by the emission reductions achieved, in tons reduced per year. The costs can include, but are not limited to, capital equipment costs, engineering design costs, and additional labor or fuel costs. The costs also can include any monetary savings realized by implementation of the pollution controls.

Table 6 outlines the cost multipliers used to calculate the total annual cost for each engine.

Table 6 - Cost Multipliers Used for Compliance Cost Evaluation

	Engine Size (bhp)	
	Equipment Cost ($)	
A.	NSCR cost	-
B.	Air To Fuel Ratio Controller when needed	-
C.	**Equipment Cost ($)**	A+B
D.	Sales tax	8% C
E.	Freight	5% C
F.	Instrumentation	10% C

G.	**Total Purchased Equipment Cost (PEC) ($)**	C+D+E+F
Direct Installation Cost (DIC) ($)		
H.	Foundations and Supports	8% PEC
I.	Handling and Erection	14% PEC
Direct Installation Cost (DIC) ($)		
J.	Electrical	4% PEC
K.	Piping	2% PEC
L.	Insulation for Piping	1% of PEC
M.	**Total Direct Installation Cost (DIC) ($)**	H+I+J+K+L
Indirect Installation Cost (IIC) ($)		
N.	Engineering	10% PEC
O.	Construction and Field Expenses	5% PEC
P.	Contractor Fees	10% PEC
Q.	Startup	2% PEC
R.	Performance Test	1% PEC
S.	**Indirect Installation Cost (IIC) ($)**	N+O+P+Q+R
T.	**Total Installation Cost (IC) ($)**	DIC + IIC
U.	**Project Contingency ($)**	3% PEC
V.	**Total Capital Costs (TCC) ($)**	G+T+U
W.	***Annualized Capital Cost ($/yr) (10 years @ 10%)***	0.16275* TCC

A. Cost Scaling to Engine Size

Costs were submitted to the District for a certain size of engine. In order to determine costs for engines with output different than the submitted costs, District staff used the following equation:

$$Cost_{engine2} = \left[\frac{horsepower_{engine2}}{horsepower_{basis}}\right]^{0.6} \times \left(Cost_{basis}\right)$$

Where

$Cost_{engine2}$ = cost of the desired engine (unknown)
$Cost_{basis}$ = cost of the engine used as the basis of the calculation (known)
$horsepower_{engine2}$ = the rated output of the desired engine (known)
$horsepower_{basis}$ = the rated output of the engine used as the basis of the calculation (known)

B. Incremental Cost Effectiveness Analysis

Health and Safety Code section 40920.6 requires an incremental cost-effectiveness analysis for Best Available Retrofit Control Technology (BARCT) rules or emission reduction strategies when there is more than one control option which would achieve the emission reduction objective of the proposed amendments. The incremental cost effectiveness is the difference in cost between successively more effective controls divided by the additional emission reductions achieved. Incremental cost-effectiveness is calculated as follows:

$$\textit{Incremental cost-effectiveness} = (C_{alt} - C_{proposed}) / (E_{alt} - E_{proposed})$$

Where:
$C_{proposed}$ is the present worth value of the proposed control option;
$E_{proposed}$ are the emission reductions of the proposed control option;
C_{alt} is the present worth value of the alternative control option; and
E_{alt} are the emission reductions of the alternative control option

Proposed Rule 4702 requires engines to meet stringent emissions limits. The progressively more stringent control option is to require all lean-burn engines to be retrofit with a SCR system to meet a limit of 11 ppmv, and all rich-burn engines to upgrade their NSCR systems to meet a limit of 7 ppmv.

The progressively more stringent NOx control options would impact an additional 123 engines, cost $24,292,931 per year, and achieve 907 tons of NOx emissions reductions. The incremental cost-effectiveness for requiring a NOx limit of 7 ppmv for all rich-burn engines and 11 ppmv for lean-burn engines is $133,872 per ton of emissions reduced, as calculated below.

$$\textit{Incremental cost-effectiveness} = (\$24{,}292{,}931 - \$1{,}133{,}058) / (907_{tons/NOx} - 734_{tons/NOx})$$

Thus, the progressively more stringent control option was not chosen.

APPENDIX D

Socioeconomic Analysis
For Proposed Amendments to Rule 4702

August 19, 2021

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POTENTIAL AMENDMENTS TO RULE 4702—INTERNAL COMBUSTION ENGINES

SOCIOECONOMIC IMPACT ANALYSIS

Final

July 7, 2021

Submitted to:

San Joaquin Valley Air Pollution Control District
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Submitted by:

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District Agreement No. CONT-00656

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1. EXECUTIVE SUMMARY

This report contains ERG's analysis of the socioeconomic impacts of potential amendments to the San Joaquin Valley Air Pollution Control District (SJVAPCD or District) Rule 4702 (Internal Combustion Engines). Potential amendments to Rule 4702 would establish more strict nitrogen oxides (NOx) and volatile organic compounds (VOC) limits than in the existing rules (SJVAPCD, 2020a).

After providing an overview of demographic and economic trends in the District as a whole and describing how the COVID-19 pandemic has impacted the District economically, ERG estimates the impacts of the potential amendments on entities that would incur costs under the potential amendments by comparing compliance costs to profits.

As seen in Table 1, the overall impacts of the rule for all affected sectors are **4.61 percent** of profits. No affected sector would experience a significant adverse socioeconomic impact, defined as costs that amount to 10 percent or more of profits (Berck, 1995). The "Agriculture" sector has most of the affected facilities and would also have the highest impacts, at **7.60 percent of** profits. (Note that these impacts reflect a COVID-19-adjusted baseline, as detailed further in Section 4.1.2 below. These impacts are expected to decline as the country and economy recover from the effects of the COVID pandemic.)

Note that this rule would affect a total of four facilities in the "Water Supply and Storage" and "Wastewater Treatment" sectors. Those facilities are operated by local government agencies, which do not seek to maximize profits in the same way that private entities do, and therefore profit values are not shown in the following and subsequent tables. Local governments commonly raise fees to cover the compliance costs of regulations, and will likely plan for incurring these additional costs through their annual budgeting processes. Based on the average annualized cost per facility for the "Government" sector, there does not appear to be a significant impact to these types of facilities.

Table 1. Summary of Socioeconomic Impacts due to Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Affected Facilities (2023 and 2029)	Total Annualized Cost [a]	Average Annualized Cost per Facility	Average Profits per Firm	Cost as % Profits
Agriculture	203	$1,042,564	$5,136	$67,532	7.60%
Oil and Gas Production	2	$68,460	$34,230	$5,361,445	0.64%
Scrap and Waste Materials	1	$3,732	$3,732	$148,324	2.52%
Water Supply and Storage [b]	2	$5,505	$2,752	—	—
Wastewater Treatment [b]	1	$12,797	$12,797	—	—
Total/Average	**209**	**$1,133,058**	**$5,421**	**$117,609**	**4.61%**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.

Notes:

[a] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.

[b] The "Water Supply and Storage" and "Wastewater Treatment" sectors are composed of government agencies, so profit values are not shown here.

As a secondary measure of impacts, ERG also used the IMPLAN (2020a) input-output model to assess how facilities with costs under the potential amendments might react by reducing employment, as well as a "ripple effect" felt if affected facilities reduce purchases from their suppliers, and their suppliers in turn reduce their own purchases. These impacts make up less than **0.001 percent** of District-wide revenue and employment.

ERG also conducted sensitivity analyses to assess how varying degrees of recovery from the effects of the COVID-19 pandemic might affect the results of the analysis. Impacts would be reduced with a full recovery, as IMPLAN (2020a) data suggests that revenues for the agricultural sector (which includes most of the affected facilities) have declined due to the COVID-19 pandemic.

2. INTRODUCTION AND BACKGROUND

This report provides economic data and analysis in support of the San Joaquin Valley Air Pollution Control District ("the District" or SJVAPCD) assessment of the socioeconomic feasibility of potential amendments to its existing Rule 4702 (Internal Combustion Engines). This work was performed by ERG under District Agreement No. CONT-00656.

Internal combustion engines are used by a variety of private businesses and public agencies throughout the Valley for a number of purposes. Primary uses of internal combustion engines in the Valley include powering irrigation pumps, compressors, electrical generators, and emergency standby engines. Examples of businesses and industries that use internal combustion engines include agriculture, oil and gas production, landfill and wastewater treatment facilities, water districts, and manufacturing.

Existing District Rule 4702, last amended in 2013, is designed "to limit the emissions of NOx, carbon monoxide (CO), VOC, and sulfur oxides (SOx) from internal combustion engines" and applies "to any internal combustion engine rated at 25 brake horsepower or greater" (SJVAPCD, 2013).

The potential amendments to Rule 4702 will satisfy commitments included in the *2018 PM2.5 Plan* to lower NOx emission limits for a number of internal combustion engines categories, lower VOC limits to 90 ppmv for all categories of internal combustion engines, and remove the emissions fee compliance option. The potential amendments would require compliance for non-agricultural engines and agricultural rich-burn engines by the end of 2023 and agricultural lean-burn engines by the end of 2029 (SJVAPCD, 2020a).

This analysis was prepared to meet the requirements of California Health and Safety Code §40728.5, which requires an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of air district rules. It begins by providing an overview of demographic and economic trends in the District, and then estimates the economic impacts on specific entities subject to the potential rule amendments (including small entities), and how those economic impacts might affect the surrounding communities, including at-risk populations.

3. REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS

In this section ERG considers larger demographic and economic trends in the District, which includes eight counties that are home to over 4 million people.[1] These counties have become more populous over the last decade, and the median income (adjusted for inflation) has also increased. Utilities, wholesale and retail trade, and transportation, along with agriculture and oil and gas extraction, are the predominant industries within the District both in terms of establishments and employment.

3.1. REGIONAL DEMOGRAPHIC TRENDS

This section presents the demographic shifts within the District's jurisdiction over the past decade. The District has experienced greater population growth rate than the state as a whole, but the median income has lagged the state. The poverty rate throughout the District, while decreasing over time, is doing so at a slower pace than California as a whole.

The San Joaquin Valley contains almost 11 percent of the state of California's population. Table 2 shows how this population has changed over the last 10 years. Table 2 also shows the compound annual growth rate (CAGR) between 2010 and 2019. The CAGR is the constant rate the population would have changed annually to go from the 2010 level to the 2019 level.

The region has seen small amounts of population growth, an annual average growth rate marginally higher than the state of California. Kings and Madera Counties, the two counties with the smallest population of the counties in the District, saw little growth in their populations from 2010 to 2019, and were the only counties to have population declines in any one year over the last ten years. San Joaquin County saw the most growth, increasing at 1.16 percent annually.

[1] While only part of Kern County falls into the District's boundaries, all of Kern County is included in the data presented in this section, as the data were only available at the county level.

Table 2. Population Trends by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	932,039	939,406	945,045	951,514	960,567	969,488	976,830	985,238	991,950	999,101	0.78%
Kern [a]	840,996	847,970	853,606	862,000	869,176	876,031	880,856	887,356	893,758	900,202	0.76%
Kings	152,370	151,868	150,991	150,337	149,495	150,085	149,382	149,665	151,382	152,940	0.04%
Madera	150,986	151,675	151,527	151,370	153,456	153,576	153,956	155,423	156,882	157,327	0.46%
Merced	256,721	259,297	260,867	262,026	264,419	266,353	267,628	271,096	274,151	277,680	0.88%
San Joaquin	687,127	694,354	699,593	702,046	711,579	722,271	732,809	743,296	752,491	762,148	1.16%
Stanislaus	515,145	517,560	520,424	523,451	528,015	533,211	539,255	544,717	548,126	550,660	0.74%
Tulare	442,969	446,784	449,779	452,460	455,138	457,161	459,235	462,308	464,589	466,195	0.57%
SJVAPCD [a]	**3,978,353**	**4,008,914**	**4,031,832**	**4,055,204**	**4,091,845**	**4,128,176**	**4,159,951**	**4,199,099**	**4,233,329**	**4,266,253**	**0.78%**
California	**37,319,502**	**37,638,369**	**37,948,800**	**38,260,787**	**38,596,972**	**38,918,045**	**39,167,117**	**39,358,497**	**39,461,588**	**39,512,223**	**0.64%**

Source: U.S. Census Bureau, 2020d.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 3 shows the median income by county for 2010 through 2018 U.S. Census Bureau (2019a).[2] Median income growth rates varied across counties from 2010 to 2018, though the counties in the District as a whole had a CAGR of 0.63 percent overall; this is significantly lower than the growth rate of median income for the state of California (1.60 percent). Kern and Tulare Counties experienced declines in median income (-0.17 percent and -0.26 percent respectively) while all other counties experienced some level of growth. Kings and Merced Counties have notably higher growth rates of 2.34 percent and 2.13 percent, respectively. These are the only two counties in the District where median income increased at a rate faster than the state.

[2] 2018 is the most recent data year currently available in the U.S. Census Bureau (2019a) median income data from the American Community Survey.

Table 3. Median Income by County [a]

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	$52,859	$49,014	$46,766	$48,496	$47,071	$50,369	$51,728	$53,987	$53,547	0.16%
Kern [b]	$53,213	$51,781	$51,578	$51,758	$51,647	$55,082	$52,990	$51,959	$52,478	-0.17%
Kings	$52,144	$57,645	$51,606	$50,538	$46,378	$49,078	$56,527	$59,985	$62,738	2.34%
Madera	$56,421	$53,323	$47,229	$43,896	$45,998	$50,585	$54,852	$53,448	$57,287	0.19%
Merced	$49,619	$45,863	$48,979	$44,921	$47,788	$45,056	$50,692	$49,750	$58,752	2.13%
San Joaquin	$58,458	$58,227	$56,984	$56,785	$55,999	$57,617	$63,199	$63,746	$65,237	1.38%
Stanislaus	$56,159	$50,467	$52,134	$52,954	$55,376	$56,177	$57,664	$62,027	$61,373	1.12%
Tulare	$50,727	$47,136	$45,277	$43,525	$46,191	$45,503	$48,719	$48,219	$49,668	-0.26%
SJVAPCD [b][c]	**$53,990**	**$51,459**	**$50,426**	**$50,318**	**$50,550**	**$52,467**	**$54,674**	**$55,614**	**$56,791**	**0.63%**
California	**$67,455**	**$65,594**	**$65,529**	**$66,454**	**$67,136**	**$69,198**	**$71,929**	**$74,837**	**$76,589**	**1.60%**

Source: U.S. Census Bureau, 2019a.

Notes:

[a] Inflated values to 2019$ using the BEA (2020) GDP deflator.

[b] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

[c] Median income for SJVAPCD is a weighted average by population.

Poverty rates by county for the same nine-year period are shown in Table 4. The poverty rate decreased in every county in the District in that time frame. Poverty rates within the District are higher than state average, and declining at a slower rate overall compared to the state of California's rate of -2.60 percent. Fresno and Tulare Counties consistently had the highest poverty rates while Stanislaus and San Joaquin Counties had the two lowest. San Joaquin and Stanislaus Counties were also the only two counties in the District with a lower CAGR lower than the state. Despite Merced County's notable CAGR of median household income, its poverty rate has declined at one of the slowest rates (-0.55 percent) in the District.

Table 4. Poverty Rate by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	26.8%	25.8%	28.4%	28.8%	27.7%	25.3%	25.6%	21.1%	21.5%	-2.72%
Kern [a]	21.2%	24.5%	23.8%	22.8%	24.8%	21.9%	22.7%	21.4%	20.6%	-0.36%
Kings	22.2%	20.5%	21.2%	21.4%	26.6%	23.6%	16.0%	18.2%	19.2%	-1.80%
Madera	21.0%	24.3%	23.6%	23.6%	22.2%	23.4%	20.3%	22.6%	20.9%	-0.06%
Merced	23.0%	27.4%	24.3%	25.2%	25.2%	26.7%	20.3%	23.8%	22.0%	-0.55%
San Joaquin	19.2%	18.1%	18.4%	19.9%	20.9%	17.4%	14.4%	15.5%	14.2%	-3.70%
Stanislaus	19.9%	23.8%	20.3%	22.1%	18.0%	19.7%	14.2%	13.5%	15.6%	-3.00%
Tulare	24.5%	25.7%	30.4%	30.1%	28.6%	27.6%	25.2%	24.6%	22.5%	-1.06%
SJVAPCD [a]	**22.5%**	**23.8%**	**24.2%**	**24.6%**	**24.3%**	**22.7%**	**20.6%**	**19.7%**	**19.3%**	**-1.91%**
California	**15.8%**	**16.6%**	**17.0%**	**16.8%**	**16.4%**	**15.3%**	**14.3%**	**13.3%**	**12.8%**	**-2.60%**

Source: U.S. Census Bureau, 2019b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 5 shows the population below the poverty line from 2010 to 2018. While there was a decline in the number of people below the poverty line from 2010 to 2018, the number fluctuated during this period. The number of people in poverty grew by over 100,000 between 2010 and 2014, but has declined since 2014.

The CAGR of population below the poverty line varies across counties. Fresno County had the largest population below the poverty line as of 2018, which coincides with its large population and relatively higher poverty rate. Conversely, San Joaquin County has a notable decline in CAGR at -2.56 percent, one of three counties to see declines in poverty at a rate faster than the state (along with Fresno and Stanislaus Counties). Kern, Madera, and Merced Counties have positive CAGR and have seen an increase in population below the poverty over the nine-year period.

Table 5. Population Below Poverty Line by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	246,196	238,706	264,738	270,072	263,220	242,083	247,507	205,291	209,799	-1.98%
Kern [a]	171,950	201,230	196,625	189,484	208,388	186,501	193,133	184,619	178,239	0.45%
Kings	30,425	27,101	27,819	28,473	35,623	31,453	21,565	24,935	26,299	-1.81%
Madera	29,936	34,148	33,936	34,242	32,432	34,227	29,736	33,482	31,191	0.51%
Merced	58,360	70,243	62,448	64,552	65,405	70,118	53,314	63,485	59,283	0.20%
San Joaquin	128,748	123,258	126,610	137,663	146,601	123,817	103,399	113,136	104,622	-2.56%
Stanislaus	101,335	122,212	104,559	114,628	94,586	104,801	76,191	73,254	85,073	-2.16%
Tulare	107,660	113,515	135,194	135,066	129,485	125,728	114,290	112,524	103,711	-0.47%
SJVAPCD [a]	**874,610**	**930,413**	**951,929**	**974,180**	**975,740**	**918,728**	**839,135**	**810,726**	**798,217**	**-1.14%**
California	**5,783,043**	**6,118,803**	**6,325,319**	**6,328,824**	**6,259,098**	**5,891,678**	**5,525,524**	**5,160,208**	**4,969,326**	**-1.88%**

Source: U.S. Census Bureau, 2019b.

Notes:

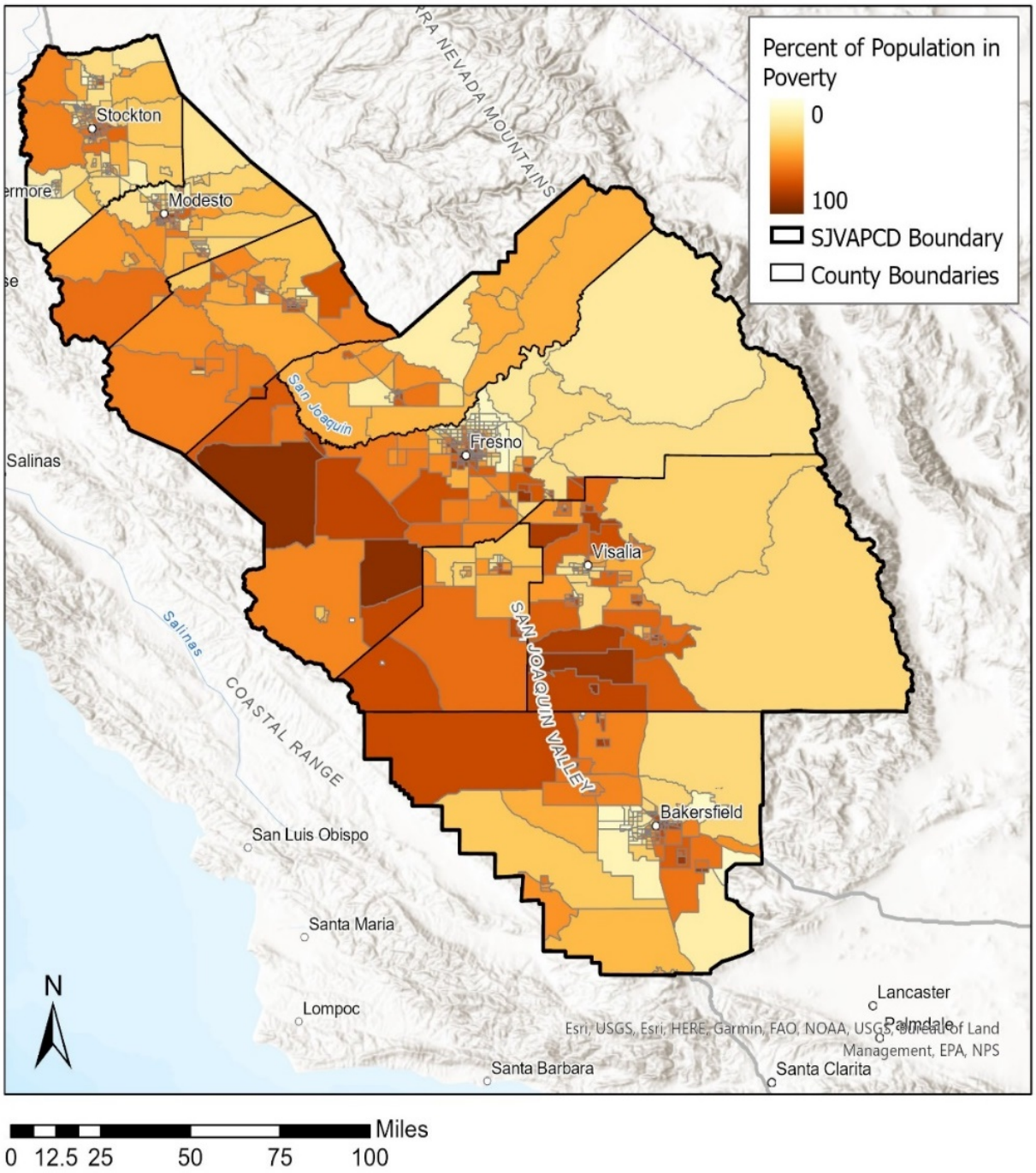
[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Figure 1 shows where the population in poverty or at risk of poverty lives within the District[3] using CalEnviroScreen 3.0 (OEHHA, 2018) data on the percent of population living below two times the federal poverty limit. CalEnviroScreen poverty data is derived from the US Census Bureau's American Community Survey 5-year estimates for 2011 to 2015. CalEnviroScreen uses a poverty threshold of two times the poverty level to account for the higher cost of living in California compared to other parts of the country (OEHHA, 2017).

As shown in Table 4 above, roughly 20 percent of the District population is below the federal poverty limit, depending on the year. Using the higher CalEnviroScreen 3.0 threshold, nearly half (48.7 percent) of District residents are below twice the federal poverty limit (OEHHA, 2018), reflected in the high poverty rates in the map in Figure 1 below.

[3] Note that only the part of Kern County included in the SJVAPCD is shown. There are four census tracts on the eastern border of Kern County that are in the Eastern Kern Air Pollution Control District. The portions of these census tracts that fall outside of the SJVAPCD border are not shown.

Figure 1. Percentage of the Population Living below Two Times the Federal Poverty Level by Census Tract (2018)



Source: OEHHA, 2018.

3.2. REGIONAL ECONOMIC TRENDS

This section tracks the economic trends in the District over the past decade. Total employment growth in the District is slightly below that of California. Overall, employment, the number of establishments, and average pay have all increased across the District during that period.

Table 6 presents employment trends over the same 10-year span. During that period, overall employment throughout the District has also increased. The District as a whole saw a CAGR of 1.48 percent in employment over the last decade, slightly below that of the entire state of California (1.64 percent). No individual county experienced a decline in employment, although Kings County has a notably lower growth rate (0.72 percent) than the other counties in the region.

San Joaquin County was the only county in the District to experience an employment growth rate greater than that of California as a whole. This may be in part due to the California Central Valley Economic Development Corporation's (CCVEDC) efforts to encourage companies to locate within the District through tax credits and incentives and grants (CCVEDC, 2020). A few large employers (Amazon, Tesla, etc.) have moved to San Joaquin County in recent years, creating numerous job opportunities within the county. Some people have also moved from the more expensive Bay Area and Los Angeles-San Diego area to the Central Valley, with San Joaquin County being one of the more popular areas to relocate (Lillis, 2019).

Table 6. Employment Trends by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	366,200	370,200	373,500	379,800	387,500	395,700	402,700	407,400	412,783	418,092	1.48%
Kern [a]	313,400	325,700	340,400	347,200	351,700	350,500	348,000	349,500	354,892	360,783	1.58%
Kings	49,900	49,700	50,000	50,400	50,600	51,700	51,500	52,300	53,025	53,233	0.72%
Madera	51,400	52,000	53,500	54,400	54,900	53,500	55,400	56,100	56,958	57,642	1.28%
Merced	93,200	94,500	96,200	98,000	99,700	101,200	102,300	104,600	105,650	106,875	1.53%
San Joaquin	260,000	261,000	267,100	274,600	279,200	286,600	292,600	301,100	304,617	307,842	1.89%
Stanislaus	202,200	202,400	205,900	209,800	213,700	218,200	222,000	224,400	227,533	228,750	1.38%
Tulare	168,100	168,700	168,800	172,200	172,100	178,700	180,700	183,500	183,300	184,350	1.03%
SJVAPCD [a]	**1,504,400**	**1,524,200**	**1,555,400**	**1,586,400**	**1,609,400**	**1,636,100**	**1,655,200**	**1,678,900**	**1,698,758**	**1,717,567**	**1.48%**
California	**16,091,900**	**16,258,100**	**16,602,700**	**16,958,400**	**17,310,900**	**17,681,800**	**18,002,800**	**18,285,500**	**18,460,433**	**18,623,900**	**1.64%**

Source: CA EDD, 2020a.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 7 shows the economic trends by sector in the District by presenting three snapshots from 2009 to 2019 using data from the Bureau of Labor Statistics' (BLS, 2020) Quarterly Census of Employment and Wages (QCEW). The recent influx of new employers explains the continued growth in the utilities, trade and transportation industries. These industries have been the largest employers in the District for the last 11 years, followed closely by agriculture and oil and gas extraction. The education, health and social services industry has seen the greatest increase of establishments in the District over the past decade, although it is the one industry that has experienced a decrease in average pay over that same time frame. The information sector is the smallest industry in the district and has gotten smaller over the last 11 years.

Table 7. Economic Trends in the San Joaquin Valley, 2009-2019 [a]

NAICS	Sector	2009			2014			2019		
		Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay
11, 21	Agriculture, Oil and Gas Extraction	7,789	189,766	$29,692	7,438	217,769	$33,068	7,430	217,649	$36,568
23	Construction	6,099	50,178	$55,144	5,377	56,011	$54,022	6,637	70,498	$59,475
31-33	Manufacturing	2,640	105,142	$52,640	2,531	107,702	$53,749	2,715	110,892	$55,863
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	14,041	219,813	$40,871	14,500	246,596	$41,428	16,026	282,861	$43,587
51	Information	602	13,482	$59,608	510	11,035	$68,525	498	6,127	$60,315
52-53	Finance Activities	5,747	44,703	$52,430	5,652	41,123	$55,695	6,443	42,638	$59,747
54-56	Profession and Business Services	7,944	97,494	$45,994	8,391	106,412	$45,985	9,054	116,895	$50,424
61-62	Educational, Health and Social Services	7,503	140,416	$54,050	39,280	184,959	$47,321	53,489	223,552	$48,667
71-72	Leisure and Hospitality	5,960	97,885	$17,407	6,224	111,610	$16,859	7,424	130,279	$19,906
81	Other Services	38,938	53,413	$24,934	5,124	32,856	$33,084	5,603	24,860	$35,245
99	Unclassified	1,730	2,112	$34,651	1,917	3,006	$31,870	4	4	$25,752
SJVAPCD Total/Average [b]		**98,993**	**1,014,404**	**$40,664**	**96,944**	**1,119,079**	**$41,095**	**115,323**	**1,226,255**	**$43,903**

Source: BLS, 2020.

Notes:

[a] Includes all of Kern County.

[b] Annual average pay is a weighted average of the eight counties in the SJV APCD weighted by employment in sector.

[c] Annual average pay is adjusted to 2019 dollars using the BEA (2020) GDP deflator.

Table 8 presents the CAGR of the economic data from Table 7. The number of establishments, employment, and average annual pay have all increased over the last 11 years across the District. Health, education, and social services has seen the greatest growth in establishments and employment over that time frame, but it is the one industry that experienced a decrease in average pay (outside of the unclassified businesses). There are fewer establishments in the agriculture, oil, and gas extraction industry today than there were a decade ago, but employment and pay have both increased. The information industry has experienced the greatest decrease in employment across the District.

Table 8. Compound Annual Growth Rate of Establishments, Employment, and Annual Pay [a]

NAICS	Sector	Establishments			Employment			Average Annual Pay		
		2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019
11, 21	Agriculture, Oil and Gas Extraction	-0.92%	-0.02%	-0.47%	2.79%	-0.01%	1.38%	2.18%	2.03%	2.10%
23	Construction	-2.49%	4.30%	0.85%	2.22%	4.71%	3.46%	-0.41%	1.94%	0.76%
31-33	Manufacturing	-0.84%	1.41%	0.28%	0.48%	0.59%	0.53%	0.42%	0.77%	0.60%
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	0.65%	2.02%	1.33%	2.33%	2.78%	2.55%	0.27%	1.02%	0.65%
51	Information	-3.26%	-0.48%	-1.88%	-3.93%	-11.10%	-7.58%	2.83%	-2.52%	0.12%
52-53	Finance Activities	-0.33%	2.65%	1.15%	-1.66%	0.73%	-0.47%	1.22%	1.41%	1.32%
54-56	Profession and Business Services	1.10%	1.53%	1.32%	1.77%	1.90%	1.83%	0.00%	1.86%	0.92%
61-62	Educational, Health and Social Services	39.25%	6.37%	21.70%	5.67%	3.86%	4.76%	-2.62%	0.56%	-1.04%
71-72	Leisure and Hospitality	0.87%	3.59%	2.22%	2.66%	3.14%	2.90%	-0.64%	3.38%	1.35%
81	Other Services	-33.34%	1.80%	-17.62%	-9.26%	-5.42%	-7.36%	5.82%	1.27%	3.52%
99	Unclassified	2.07%	-70.90%	-45.50%	7.31%	-73.40%	-46.58%	-1.66%	-4.17%	-2.92%
SJVAPCD Total/Average		**-0.42%**	**3.53%**	**1.54%**	**1.98%**	**1.85%**	**1.91%**	**0.21%**	**1.33%**	**0.77%**

Source: BLS, 2020.

Notes:

[a] Includes all of Kern County.

3.3. IMPACTS OF THE COVID-19 PANDEMIC

The potential amendments to Rule 4702 would primarily impacts the agricultural sector, which has seen large-scale negative impacts across the entire U.S. due to the COVID-19 pandemic. The pandemic has caused multiple disruptions to the established agricultural supply chain. Widespread shutdowns of in-person business operations, especially of processing plants, restaurants, and schools, resulted in multiple challenges to agriculture. The closure of processing plants, either as a preventative measure or due to workers testing positive for COVID-19, also slowed the production process (Penson, 2020). This results in a mismatch of supply to meet demand for food, while farmers bear lost profitability because their produce is not being processed.

The near total closure of restaurants, bars, and wineries in the spring of 2020 resulted in a significant disruption to how and where people buy their food from. Visits to sit-down restaurants nosedived right after the federal government declared a state of emergency on March 13, 2020. Visits to these restaurants had started to recover slightly, but were nowhere near 2019 levels (Penson, 2020) before the regional stay and home order announced December 3, 2020 (COVID19.ca.gov, 2020).

Given California's disproportionately large percentage of domestic wine production, the closing of wineries was a huge economic loss for the state (ERA Economics, 2020). As a result, it is expected that the price of wine grapes will remain low with wineries shifting impacts onto producers. Stops at supermarkets spiked in mid-March, but then fell below 2019 levels, likely a result of both the general public's reduced spending capacity and the concern of contracting COVID-19 in heavily trafficked places. Both of these factors also play a role in the shift in consumer preference to more shelf-stable food items as opposed to produce (ERA Economics, 2020). California's table grape market also saw depressed prices throughout the summer of 2020 as a result of this shift in consumer demand. School closures also resulted in a reconfiguring of where children get at least some of their meals, since schools provide large amounts of food to children across the United States (Ledbetter, 2020).

This shift in consumer demand has also resulted in logistical complications for the agricultural sector. Shipping and production costs have increased, cutting deeper into the margins for agricultural business (Penson, 2020). The closure of production plants has stalled produce from reaching supermarkets and dining room tables. Even when production plants are not closed, the process is slowed due to required spacing between workers, mandatory sanitation efforts, and increased breaks for personal hygiene (ERA Economics, 2020). Port closures also slowed the distribution process, making international trade of food products, especially those that are perishable, a much less profitable endeavor. As an example, California's rice producers are heavily dependent on exporting. The export value for rice, according a summer 2020 study, was nearly 17 percent lower in March 2020 than it was a year prior (ERA Economics, 2020). Walnut producers in California will also likely face increased international competition, as global stocks of walnuts are expected to be plentiful given the complications associated with exporting. The lack of labor for farm work, transportation, and processing prevents the agricultural sector from meeting food demand as well. While immigrants are presently permitted entry into the United States for seasonal work in the agricultural sector, the risk of infection may be a deterrent to their traveling.

While it is expected that supply chain disruptions are resolved in the near term, the impacts to the agricultural sector caused by a contraction of consumer income will likely take longer to recover

from (Westhoff et al, 2020). Farm households will face losses not only from the reduced spending capacity of potential consumers, but also due to reduced off-farm income (USDA ERS, 2020). These households typically use their off-farm income to balance the losses from on-farm operations. With both reduced off-farm income and income from their agricultural products, farm households may not be able to fund some of the necessities of their on-farm operations, including production expenses and debt, as well as their own personal living expenses for day-to-day life.

While affected by the potential amendments to Rule 4702 to a much smaller extent than agriculture, some affected facilities are in the oil and gas sector. The pandemic resulted in the third oil price collapse that the oil and gas extraction industry has seen in just the last 12 years. This price shock, unlike the previous two, was swift, resulting in wide-ranging changes across the industry in a short period of time. Stay at home orders in California and around the world resulted in depressed demand for gas. Even as some of these restrictions have eased, a combination of job losses and remote work means that far fewer people are commuting. Travel for recreational activities is reduced as well, whether because facilities are closed or have restrictions in place or because people are reluctant to expose themselves to illness. Those who have lost their jobs as a result of the coronavirus are conscious of their expenses, including on travel.

The coronavirus-driven lack of demand coincided with a massive oversupply of oil that left the industry with very little storage space (Kasler, 2020). This combination of supply and demand mismatches resulted in an 87 percent drop in the Brent per-barrel price of oil from January to April of 2020 (McCarthy, 2020). Gas prices have also dropped nationwide. For instance, over a one-month period from late February to late March 2020, the price of gas dropped significantly across California, going from $3.49 to $3.20 statewide, while the prices in the metro areas of Fresno and Madera-Chowchilla both dropped from about $3.33 to just under $3.00 over that same timeframe (Sheehan, 2020). The average price of regular unleaded gasoline in California in late September 2020 ($3.22) was about 70 cents cheaper than a year prior ($3.95) (AAA, 2020). Fresno and Merced have seen similar changes to their average gas prices, albeit with slightly lower prices than the statewide average.

Oil and gas companies started to slow down production in response to demand changes. The number of rigs operating across the country has dropped by more than 70 percent since the end of August 2019 (Flores, 2020). California has seen a similar drop in rigs within the state, going from 18 rigs in operation in late August of 2019 to just four at the end of August 2020 (Baker Hughes, 2020). By and large, California's oil and gas production is centered in the San Joaquin Valley, with a majority of oil production in Kern County specifically. Before the pandemic began, nearly 10,000 people were employed within the oil and gas extraction industry in Kern County (Kasler, 2020). Rigs account for about 100 jobs each, which means that California's rig closures over the past year resulted in the loss of approximately 1,400 jobs.

The pandemic has also halted maintenance projects at refineries and pumps across the globe. With companies either shutdown or at limited working capacity, the supply of spare parts for repairs has dwindled. Maintenance workers are unable to conduct reviews of equipment. There will likely be a backlog of maintenance projects to attend to once all lockdowns are lifted, and companies will want to get as much maintenance work done as soon as possible given the lost production time (Yagova, George, and Sharafedin, 2020). Typically, companies perform maintenance inspections during lulls in

production. Instead, they will need to conduct these inspections when production should be picking up. This will further delay crude production, slowing the industry's ability to recover.

Unlike previous economic hits to the industry, oil and gas extraction will likely not recover quickly from this downturn. Where some industries are hoping for a "V-shaped" recovery, oil and gas extraction is more likely to recover in a "U-shaped," with a protracted downturn before recovery begins (Flores, 2020). The industry will likely be looking at flat or even decreased demand post-pandemic, with technology leading supply response instead of workers (Barbosa et al, 2020).

Some local government-operated facilities will also be affected by the potential amendments to Rule 4702. The public sector's outlook has also drastically changed due to the pandemic. State and local governments across the country are now experiencing significantly altered fiscal budgets. With the private sector struggling to attract business, the public sector has seen their projected budgets move into shortfall territory (McNichol & Leachman, 2020). The coronavirus-induced recession is estimated to cause greater budgetary shortfalls than the Great Recession of 2008. While the CARES Act granted state and local government federal aid to help offset these budgetary constraints, it is not enough. States in total also have about $75 billion in 'rainy day' funds, but this also is not enough to weather the shortage of government revenues.

Tax revenues are expected to diminish as a result of the pandemic. Income taxes will decrease with greater unemployment (Sheiner & Campbell, 2020). Revenues from sales taxes have also decreased because of reduced spending on entertainment and travel. As a result, state and local officials have started cutting funding for numerous programs. According to analysis from the League of California Cities, no matter their size, the vast majority of cities will have to cut spending on their public services. Even spending on core services will be cut, with between 78 and 90 percent of cities cutting public safety budgets and 71 to 90 percent cutting housing budgets (League of California Cities, 2020).

Public sector employment was also cut as a result of the pandemic. While most job loss was focused on education in the public sector, local governments lost approximately 523,000 jobs in non-education related areas from March through May (NACo, 2020).

Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, ERG uses a "COVID-adjusted baseline" for these metrics, as discussed further in Section 4.1.2 below.

4. SOCIOECONOMIC IMPACT ANALYSIS

ERG calculated the direct impacts of the proposed rule amendments by comparing the costs of compliance to profits of affected facilities. ERG estimated potential employment impacts using IMPLAN's (2020a) input-output model. Additionally, ERG used the IMPLAN model to capture indirect and induced impacts (i.e., impacts that might arise if directly impacted entities reduce purchases from their suppliers and households adjust their spending as a result of changes in earnings).

4.1. DATA SOURCES AND METHODOLOGY

To estimate socioeconomic impacts, ERG compares the costs of compliance with the potential amendments with profits per facility. ERG sought to create a profile, including employment, revenue, profits, and average pay per employee, for each affected sector. The process of estimating each of these profile elements also requires other data to be used (e.g., facility name, address).

This section describes the data sources used to create the baseline industry profile, how this profile was adjusted to capture the impacts of the COVID-19 pandemic, and how socioeconomic impacts were estimated.

The sections that follow detail the resulting profile of affected entities and the socioeconomic impacts of compliance with the potential rule amendments.

4.1.1. Baseline Industry Profile Estimates

SJVAPCD (2020b) provided ERG with an initial list of affected facilities, including fields for facility ID, facility description, Standard Industrial Classification (SIC) code, number of emissions sources, and unit location.

ERG next identified additional data points for use in the analysis. For instance, SJVAPCD's (2020b) facility data includes a SIC code which ERG converted to the North American Industry Classification System (NAICS) codes. NAICS codes are used with other sources of economic data in the analysis based on a combination of U.S. Census Bureau (2020a) concordances.[4] Where a SIC code could map to multiple NAICS codes, ERG used information on companies' websites or other search tools about what type of industry they are engaged in to assign a NAICS code. (See Appendix A for a list of the NAICS code(s) that mapped to each SIC code.)

Employment and revenue data for most private industries were drawn from the U.S. Census Bureau's (2020b) Economic Census, using 2017 data for California. Where data for certain industries

[4] SIC codes were last updated in 1987, and NAICS codes were first issued in 1997. The U.S. Census Bureau's (2020a) concordances map 1987 SIC codes to 1997 NAICS codes, and from there to the NAICS codes that are revised every five years (thus far in 2002, 2007, 2012, and 2017). SIC and NAICS codes are available at different levels of granularity. The SIC codes used in SJVAPCD's (2020b) data are 4-digit SIC codes, and ERG mapped these to 4-digit NAICS codes.

were not available, [5] ERG instead used estimates from the U.S. Census Bureau's (2015) Statistics of U.S. Businesses for 2012 for California.[6]

For the agricultural sector, revenue data are available in the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS, 2019) Census of Agriculture for California for 2017. The NASS data include revenue by farm acreage and commodity, and ERG created a weighted average revenue for each agricultural NAICS code based on the distribution of farms by acreage and NAICS code in the data provided to ERG by the District on the acreage of the affected facilities.[7] Agricultural employment data are drawn from the California Employment Development Department (CA EDD, 2020b) and are for California for 2017.

To estimate average payroll per employee, data for private entities by sector come from BLS' (2020) QCEW. For state and local government entities, data are from the U.S. Census Bureau's (2017a) State and Local Government Employment and Payroll and U.S. Census Bureau's (2017b) Government Units Survey. For federal entities, data are an Office of Personnel Management (OPM, 2017) estimate of the average base salary for full-time permanent employees.

ERG estimated profits for private industries by multiplying revenue figures by the average profit rate for each NAICS for 2010 through 2013 using data from the Internal Revenue Service (IRS, 2016) "SOI Tax Stats - Corporation Source Book." The profit rate was calculated as "Net Income (less deficit)" divided by "Total Receipts."[8] (See Appendix B for profit rates by NAICS code.) For agricultural industries (which are not included in the IRS data at a granular level) ERG used data from the Risk Management Association's (RMA, 2020 Annual Statement Studies). The RMA studies are prepared standardized income statements from data submitted by individual enterprises to assess risk and evaluate financial performance relative to other enterprises in the same industry.

4.1.2. COVID-19-Adjusted Baseline Industry Profile Estimates

To reflect the impact of the COVID-19 pandemic, ERG estimates **"COVID-adjusted" baseline**, which alters employment, revenue, and payroll figures for each facility using IMPLAN (2020a) data. IMPLAN's "Evolving Economy" data use economic data points from the second quarter of 2020 to reflect the impacts on the pandemic, taking into account industry losses, shifts in household spending and behavior, stimulus checks and unemployment benefits, and Paycheck Protection Program (PPP) loans (Demski, 2020). IMPLAN uses only the second quarter 2020 data, adjusts it for seasonality, and annualizes the single quarter of data to represent an entire year. This annualization approach means that IMPLAN models 2020 as if the entire year had an economy like in the early stages of the pandemic,

[5] U.S. Census (2020b) Economic Census data were not available for California for NAICS 1151 Support Activities for Crop Production, and 2212 Natural Gas Distribution.

[6] U.S. Census Bureau (2020c) Statistics of U.S. Businesses estimates for 2017 that include state-level revenue data will not be released until January 2021.

[7] The District's acreage estimates were drawn from data collected as part of the Conservation Management Practices (CMP) program and inspection reports. In cases where one farm has multiple emissions sources under different SIC codes, acreage for that farm was divided equally among the relevant codes.

[8] 2013 is the most recent year for which profit rate data are available.

without the relatively normal first quarter of 2020 and without any level of recovery later in the year (Clouse, 2020).

While the IMPLAN data for 2020 reflect the impacts of the COVID-19 pandemic and government response, it is important to note that it does not *only* capture the impacts of the pandemic, as other factors may be driving changes between 2018 and 2020 (Clouse, 2020).

Using outputs of the IMPLAN model, ERG estimates the percentage change in employment, revenue, and payroll by NAICS between 2018 (the second-most recent year for which data are available) and 2020 (the "Evolving Economy" dataset, the most recent estimate). District-wide, this approach suggests that revenue contracted by 8 percent, and employment contracted by 9.8 percent (see Table 9).

Table 9. District-Wide COVID-19 Impacts

	2018	2020 Q2 [a]	% Change
Revenue	$333.1 billion	$306.5 billion	-8.0%
Employment	2.0 million	1.8 million	-9.8%

Source: IMPLAN, 2020a.

Note:

[a] Data are modeled for an entire year as if it were like the second quarter of 2020 (i.e., the early stage of the pandemic.)

To estimate the impacts of the COVID-19 pandemic on individual industries, ERG multiplies the percentage change from 2018 to the second quarter of 2020 in the IMPLAN model by the baseline data to produce "COVID-adjusted" estimates for each NAICS code (which was then mapped onto SIC codes for use in conjunction with the cost data provided by SJVAPCD (2020c)). In most industries, this results in decreased revenue and employment, but *increased* average payroll per employee, reflecting the fact that more workers in lower-paid occupations have been laid off than workers in higher-paid administrative and executive occupations (Clouse, 2020).

The agricultural sector saw a decrease in revenue and employment between 2018 and the second quarter of 2020, with revenue down between 14.7 and 17.5 percent and employment down between 12.7 and 14.9 percent (depending on the NAICS industry). Related industries, such as NAICS 1151 Support Activities for Crop Production also saw decreases in this period (a 32.2 percent decrease in revenue and 13.9 percent decrease in employment).

While the pattern of economic recovery from the effects of the COVID-19 pandemic is unknown, many sectors may have fully or partially recovered by the time compliance with the potential rule amendments is required at the end of 2023 or 2029. To capture this, while the primary analysis includes the worst-case scenario of no recovery, ERG also performed three sensitivity analyses assuming 30 percent, 70 percent, or 100 percent recovery (i.e., return to the 2018 baseline) (see the results presented in Section 4.4.3.

See Appendix C for detail on the revenue, employment, and payroll adjustments for the sectors affected by the potential amendments.

4.1.3. Estimating Impacts on Affected Entities

Cost estimates (i.e., the direct cost of the potential rule amendments by SIC code) were provided to ERG by the District (SJVAPCD, 2020c). Total costs were calculated by summing the one-time capital costs (annualized over a 10-year period using a 10 percent discount rate) and ongoing annual costs. (Note that this approach does not account for the fact that costs will not be incurred for several years, thus resulting in greater cost and impacts estimates than an approach that takes into account the time value of money.)

To estimate impacts, the direct costs of the rule (i.e., the cost of compliance with the rule) are compared to profits for each SIC code (with data for each SIC code including one or more NAICS codes).

To estimate both direct employment impacts of the potential rule amendments and indirect and induced effects, ERG used IMPLAN's (2020a) input-output model. IMPLAN "is a regional economic analysis software application that is designed to estimate the impact or ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model" (IMPLAN Group LLC, 2020b).

Based on the costs to affected facilities, the IMPLAN model estimates how many jobs might be lost in reaction to the costs to affected firms. It also estimates indirect costs (i.e., the impact to affected firms' suppliers when the direct cost of rule compliance causes affected firms to reduce their purchases from those companies) and induced impacts (i.e., how households that have lost income in turn adjust their purchases).

4.1.4. Aggregating to the Sector Level

While the inputs to the analysis are estimated on a NAICS code or SIC code basis, the results are presented with those more granular industries aggregated into a smaller number of sectors:

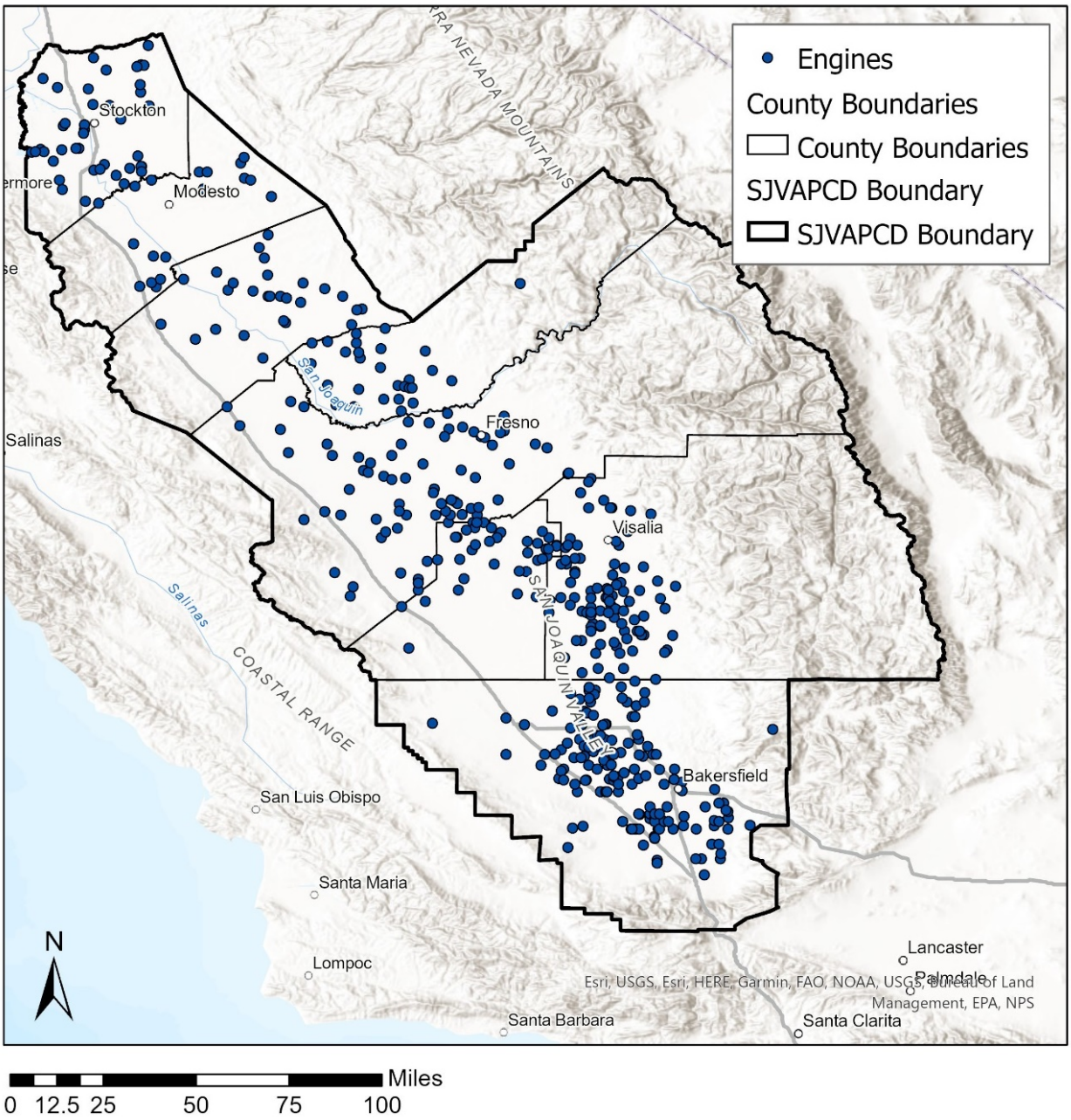
- Agriculture
- Oil and Gas Production
- Scrap and Waste Materials
- Water Supply and Storage
- Wastewater Treatment

These SIC code to sector mappings were developed by ERG and SJVAPCD (2020d). See Appendix A for a concordance between SIC codes and sectors.

4.2. PROFILE OF AFFECTED ENTITIES

Figure 2 shows the facilities operating internal combustion engines in the District. The map was created by ERG using ArcGIS Pro 2.6.0 to geocode the affected facilities. Out of the 649 total facilities (which may or may not have costs under the potential amendments to Rule 4702), 534 were mapped while the remaining facilities did not have sufficient information to be displayed.

Figure 2. Map of Facilities Operating Internal Combustion Engines



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates.
Map created by ERG using ArcGIS® software by Esri

Table 10 includes a profile of facilities affected by the potential amendments to Rule 4702 (i.e., those that will incur compliance costs). There are 143 facilities required to comply by the end of 2023 and 66 required to comply by the end of 2029, for a total of 209 facilities (assuming no overlap between those complying by 2023 and those complying by 2029).

Table 10. Profile of Facilities Affected by Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Total Facilities	2023		2029		Total		
		Affected Facilities	% Affected	Affected Facilities	% Affected	Emp-loyees	Revenue	Profits
Agriculture	560	137	24.5%	66	11.8%	545	$306,012,976	$13,709,082
Oil and Gas Production	8	2	25.0%	0	0.0%	86	$146,309,732	$10,722,889
Scrap and Waste Materials	2	1	50.0%	0	0.0%	20	$4,269,806	$148,324
Water Supply and Storage [a]	17	2	11.8%	0	0.0%	107	$474,087,512	—
Wastewater Treatment [a]	4	1	25.0%	0	0.0%	54	$237,043,756	—
Other Industries	58	0	0.0%	0	0.0%	N/A	N/A	N/A
Total	**649**	**143**	**22.0%**	**66**	**10.2%**	**813**	**$1,167,723,782**	**$24,580,295**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.
Note:

[a] The "Water Supply and Storage" and "Wastewater Treatment" sectors are composed of government agencies, so profit values are not shown here.

Table 11 shows the characteristics of the average facility affected by the potential amendments to Rule 4702. (The exact characteristics of individual facilities could be either higher or lower than these average estimates.)

Table 11. Characteristics of Average Facilities Affected by Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Average per Facility			Average Annual Pay per Employee
	Employees	Revenue	Profits	
Agriculture	3	$1,507,453	$67,532	$41,633
Oil and Gas Production	43	$73,154,866	$5,361,445	$38,934
Scrap and Waste Materials	20	$4,269,806	$148,324	$54,159
Water Supply and Storage [a]	54	$237,043,756	—	$23,376
Wastewater Treatment [a]	54	$237,043,756	—	$23,376
Average	**4**	**$5,587,195**	**$117,609**	**$38,040**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.
Note:

[a] The "Water Supply and Storage" and "Wastewater Treatment" sectors are composed of government agencies, so profit values are not shown here.

4.3. COMPLIANCE COST ESTIMATES

Compliance costs were estimated by SJVAPCD (2020c), and include:

- One-time costs for units replaced or retrofit by December 31, 2023.

- One-time costs for units replaced or retrofit by December 31, 2029.
- Annual operating and maintenance (O&M) costs for the units replaced or retrofit in 2023, beginning in 2023 and continuing indefinitely.
- Annual O&M costs (or cost savings) for the units replaced or retrofit in 2029, beginning in 2029 and continuing indefinitely.

The December 31, 2023 compliance date applies to (SJVAPCD, 2020a):

- Non-agricultural rich-burn engines
- Non-agricultural lean-burn engines
- Agricultural rich-burn engines

The December 31, 2029 compliance date applies to (SJVAPCD, 2020a):

- Agricultural lean-burn engines

Total costs are calculated by annualizing the one-time retrofit costs that will be incurred in either 2023 or 2029 over a 10-year period using a 10 percent interest rate, and then summing annualized one-time costs and annualized costs to yield the total.[9]

Table 12 shows the one-time, annual, and total annualized costs incurred by sector. Costs would total **$1.1 million**, with cost primarily incurred by facilities in the "Agriculture" sector.

Table 12. Costs of Compliance with Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Retrofit Capital Costs [a]		Retrofit O&M Costs [b]		Total Annualized Costs [c]
	One-Time		Annual		Annualized One-Time + Annual
	2023	2029	2023+	2029+	—
Agriculture	$2,438,681	$723,445	$239,040	$288,903	$1,042,564
Oil and Gas Production	$397,372	$0	$3,790	$0	$68,460
Scrap and Waste Materials	$22,930	$0	$0	$0	$3,732
Water Supply and Storage	$24,977	$0	$1,440	$0	$5,505
Wastewater Treatment	$78,630	$0	$0	$0	$12,797
Total	**$2,962,590**	**$723,445**	**$244,270**	**$288,903**	**$1,133,058**

Source: SJVAPCD, 2020c.

[a] Includes one-time capital costs for retrofit or replacement (with compliance for non-agricultural engines and agricultural rich-burn engines by the end of 2023 and agricultural lean-burn engines by the end of 2029).

[b] Includes the costs to operate and maintain the retrofit/replaced unit.

[c] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.

[9] Note that this is a conservative cost estimate in the sense that costs that will not be incurred until 2023 or 2029 are not discounted to account for the time value of money.

4.4. IMPACTS ON AFFECTED ENTITIES

This section first discusses our primary impacts test, which compares compliance costs to profits for affected facilities. ERG then discusses indirect and induced impacts to related industries, and the results of sensitivity analyses that examine results under varying degrees of economic recovery from the COVID-19 pandemic.

4.4.1. Direct Impacts

One possible metric for determining economic feasibility is a comparison of total annualized costs to profits for affected facilities, with a threshold of 10 percent of profits indicating a finding of a finding of significant adverse impact (Berck, 1995). Therefore, ERG uses this comparison to aid in the District's determination of economic feasibility of the rule amendments.

Table 13 shows the impacts of the rule by sector, which are **4.61 percent** for all affected sectors and **7.60 percent** for the "Agriculture" sector. No sector would be affected at a significant level.

Table 13. Economic Impacts for Entities Affected by Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Average Annualized Cost per Facility	Average Profits per Firm	Cost as % Profits
Agriculture	$5,136	$67,532	7.60%
Oil and Gas Production	$34,230	$5,361,445	0.64%
Scrap and Waste Materials	$3,732	$148,324	2.52%
Water Supply and Storage [a]	$2,752	—	—
Wastewater Treatment [a]	$12,797	—	—
Average	**$5,421**	**$117,609**	**4.61%**

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.

Note:

[a] The "Water Supply and Storage" and "Wastewater Treatment" sectors are composed of government agencies, so profit values are not shown here.

4.4.2. Employment, Indirect and Induced Impacts

In addition to the primary metric for estimating direct impacts on revenue (i.e., costs), ERG also assessed potential direct impacts on employment, indirect impacts, and induced impacts using IMPLAN's (2020a) input-output model. The IMPLAN model uses the direct costs of the rule to estimate "ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model" (IMPLAN, 2020b).

Outputs from the IMPLAN model include:

- **Direct employment impacts** caused if facilities with compliance costs under the potential amendments were to attempt to offset these costs by reducing the number of employees.

- **Indirect revenue and employment impacts** that capture how directly affected firms might react to the direct cost of rule compliance by reducing purchases from their suppliers, and how those suppliers might in turn reduce employees.
- **Induced revenue and employment impacts** that capture how households will adjust their spending as a result of any changes in earnings.

Table 14 summarizes these impacts, which, taken together, could have a total impact on the District economy of **$1.3 million** and **13 jobs**.

Table 14. Direct, Indirect, and Induced Impacts of Potential Amendments to Rule 4702—Internal Combustion Engines

Sector	Direct		Indirect		Induced		Total	
	Revenue (Costs)	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment
Agriculture	$1,042,564	11.95	$19,281	0.12	$2,262	0.01	$1,064,107	12.08
Oil and Gas Production	$68,460	0.09	$1,509	0.00	$398	0.00	$70,367	0.09
Scrap and Waste Materials	$3,732	0.02	$764	0.00	$827	0.00	$5,322	0.02
Water Supply and Storage	$5,505	0.02	$903	0.00	$476	0.00	$6,884	0.02
Wastewater Treatment	$12,797	0.04	$860	0.00	$366	0.00	$14,023	0.05
Other Industries	$0	0.00	$85,877	0.17	$68,570	0.42	$154,446	0.58
Total	**$1,133,058**	**12.11**	**$109,193**	**0.30**	**$72,898**	**0.43**	**$1,315,150**	**12.85**

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.
Note: Fractional employees are shown here to show how the total is derived from the direct, indirect, and induced impacts; these may represent a reduction in average hours worked.

Table 15 compares these impacts to the total size of the District's economy (as estimated in the IMPLAN model). These impacts represent **less than 0.001 percent** of revenue and employment District-wide.

Table 15. Comparison of Total Impacts against the District-Wide Economy

	Total Rule Impacts	District-Wide [a]	% of District-Wide
Revenue	$1,315,150	$306,518,988,618	0.0004%
Employment	13	1,806,161	0.0007%

Source: ERG estimates based on IMPLAN, 2020a.
Note:
[a] While the SJVAPCD only includes a portion of Kern County, the data shown here include the whole of the county.

4.4.3. COVID-19 Sensitivity Analysis

As discussed in Section 4.1.2, the primary estimates used in this analysis reflect a "COVID-19-adjusted baseline" where the baseline economic indicators are adjusted using the percentage change between IMPLAN's (2020a) 2018 and second quarter of 2020 "Evolving Economy" model. ERG also

conducted three sensitivity analyses that capture varying degrees of economic recovery from the pandemic (i.e., 30 percent, 70 percent, 100 percent).

Table 16 shows how the results of the analysis would vary under these three degrees of economic recovery. Direct costs would represent a smaller percentage of profits (i.e., economic impacts would be lower) under the recovery scenarios, as the agricultural industry's revenue recovers from the effects of the COVID-19 pandemic.

Induced impacts also increase slightly with greater COVID-19 recovery, likely because IMPLAN's (2020a) 2020 model takes into account changes in household income and spending patterns (including stimulus checks, unemployment checks, and increased saving) that is removed in the recovery scenarios.

Table 16. Results of COVID-19 Sensitivity Analyses for the Impacts of Rule 4702—Internal Combustion Engines

Analysis	Recovery from COVID-19 Baseline	Direct			Indirect		Induced		Total	
		Revenue (Costs)	Costs % Profits	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment
Primary Estimate	0%	$1,133,058	4.61%	12	$109,193	0.3	$72,898	0.4	$1,315,150	13
Sensitivity Analysis 1	30%	$1,133,058	2.24%	12	$108,842	0.3	$73,678	0.4	$1,315,578	12
Sensitivity Analysis 2	70%	$1,133,058	2.28%	11	$108,374	0.3	$74,718	0.5	$1,316,150	12
Sensitivity Analysis 3	100%	$1,133,058	2.31%	11	$108,023	0.3	$75,498	0.5	$1,316,579	11

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020b; U.S. Census Bureau, 2020c; BLS, 2020; OPM, 2017; IRS, 2016; RMA, 2020; IMPLAN, 2020a.

4.5. IMPACTS ON SMALL ENTITIES

The entities affected by the potential amendments may include small entities (i.e., small businesses and/or small government entities).

For private entities, small businesses are defined in the California Small Business Procurement and Contract Act (Cal. Gov't Code § 14837) as an independently owned and operated, non-dominant business with principal office located in California with fewer than 100 employees and earning less than $15 million in revenues.

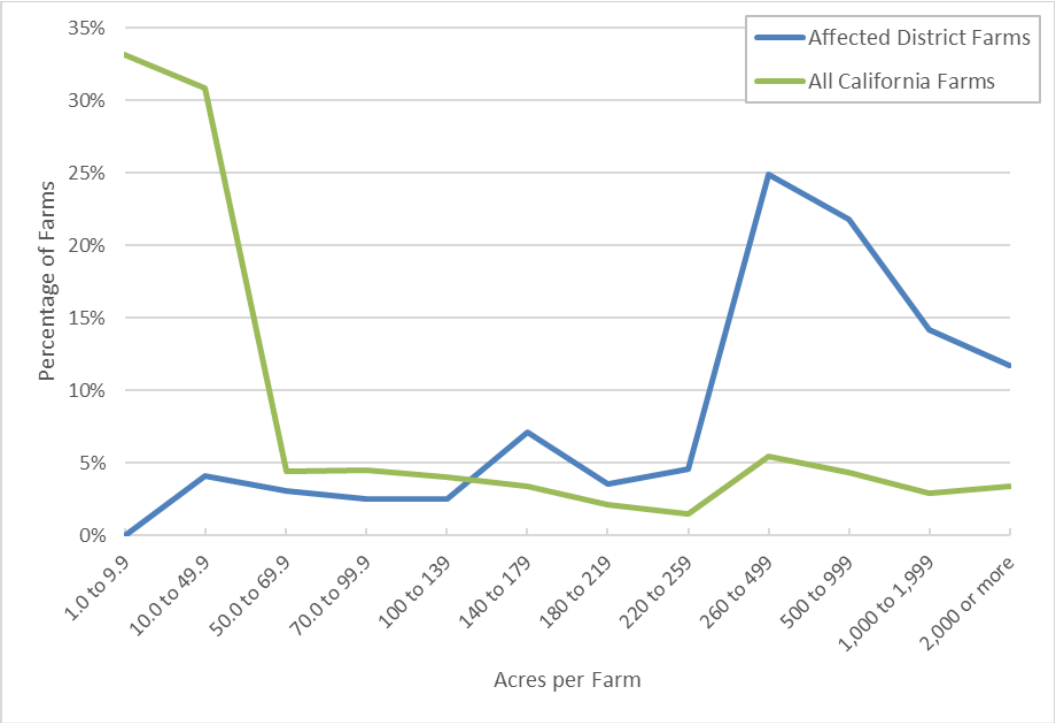
For government entities, the Regulatory Flexibility Act definition is that "a small governmental jurisdiction is a government of a city, county, town, township, village, school district, or special district with a population of less than 50,000."

Because ERG did not estimate costs on a facility-specific basis, it is not possible to identify whether any small entities are among the facilities that will incur costs under the potential rule. To the extent that small entities face similar costs to large entities but have lower profits, compliance costs will make up a greater proportion of their profits.

For engines operated by facilities in the Agriculture sector, data provided to ERG by the District on the acreage of affected farms suggests that those affected facilities in the District are larger, in terms of acreage, then farms in California as a whole (see

Figure 3; USDA NASS (2019) Census of Agriculture for California for 2017). To the extent that revenue is a function of acreage for many commodities, the affected farms are thus likely to have higher revenues than the average farm in California.

Figure 3. Distribution of Farms by Acreage in California and the District



Outside the agricultural sector, affected private sector industries include Oil and Gas Production and Scrap and Waste Materials. As noted in Table 11 above, the average facility in each of these sectors has average revenues of $73.2 million and $4.3 million, respectively (although individual affected facilities may have higher or lower revenues that the average for the sector overall).

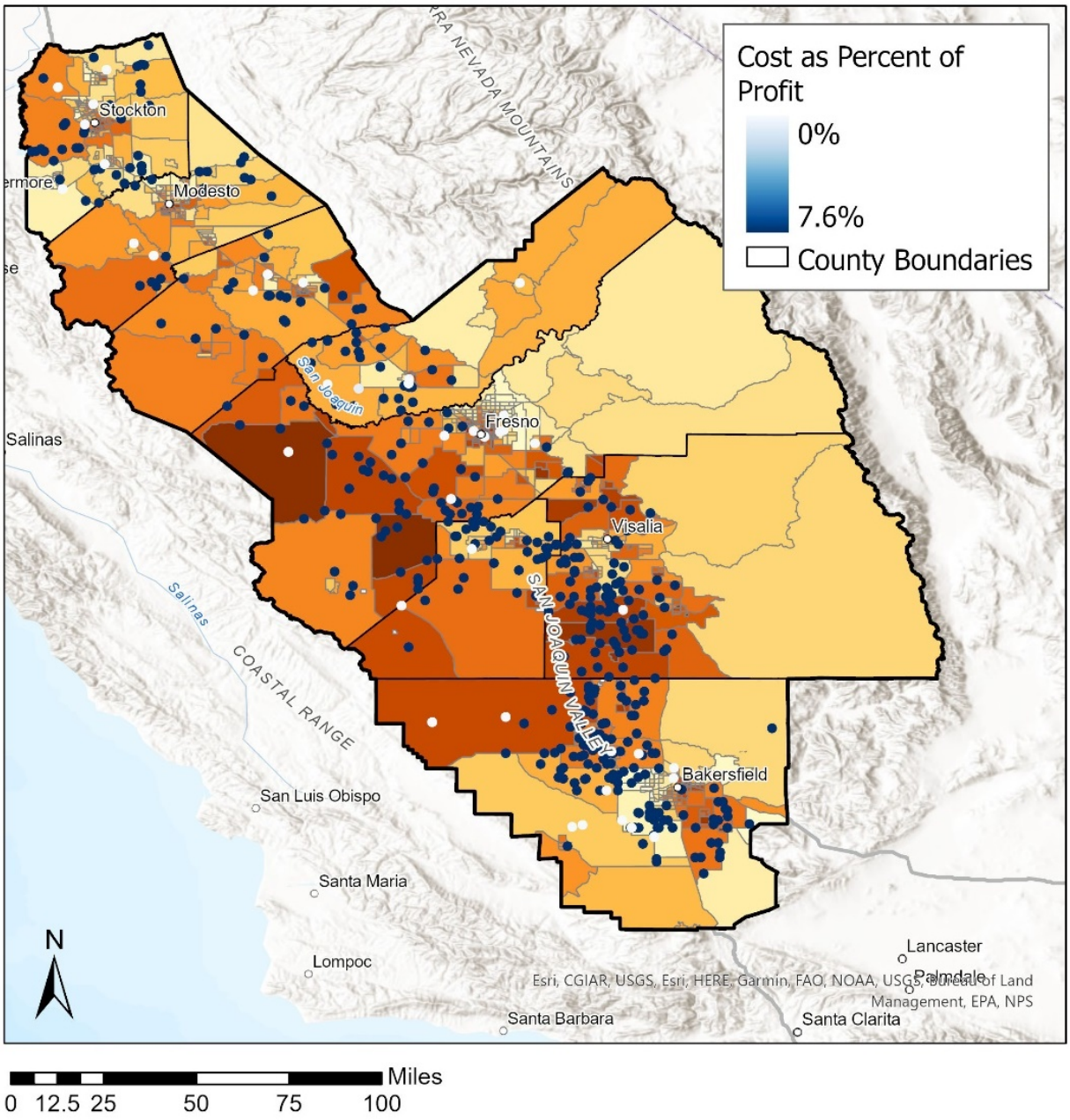
4.6. IMPACTS ON AT-RISK POPULATIONS

Cal. Gov't Code § 65040.12 defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."

The entities affected by the potential amendments may operate facilities in areas with a high number of at-risk populations. To help further the District's environmental justice goals, ERG overlaid data on the impacts of the rule with data on poverty using data from CalEnviroScreen 3.0 (OEHHA, 2018). (Note that not every facility in a given industry will necessarily be impacted by the rule, but this analysis does not include an assessment of impacts on individual facilities.)

Figure 4 presents the percent of the population living below two times the poverty rate overlaid with potentially affected facilities. The majority of facilities are agricultural and are located on the outskirts or outside of major population centers. Facilities are more heavily concentrated in the southern half of the District in Tulare, Kern and Fresno counties. There is no correlation between percent of poverty and number of facilities. However (as noted in Section 3.1 above), Kern and Tulare counties have seen less growth in median income and smaller rates of poverty decline compared to other counties in the District.

Figure 4. Map of Affected Facilities in Relation to Population Living in Poverty



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates; OEHHA, 2018
Map created by ERG using ArcGIS® software by Esri

REFERENCES

Abood, M. (2014). San Joaquin Valley Fair Housing and Equity Assessment. Available at https://www.frbsf.org/community-development/files/SJV-Fair-Housing-and-Equity-Assessment.pdf (Accessed November 10, 2020)

American Automobile Association (AAA). (2020). California Average Gas Prices. Available at https://gasprices.aaa.com/?state=CA (Accessed September 28, 2020)

Baker Hughes. (2020). North America Rotary Rig Count (Jan 2000 - Current). Available at https://rigcount.bakerhughes.com/na-rig-count (Accessed September 28, 2020)

Barbosa, F., Bresciani, G., Graham, P., Nyquist, S., and Yanosek, K. (2020). Oil and gas after COVID-19: The day of reckoning or a new age of opportunity? Available at https://www.mckinsey.com/industries/oil-and-gas/our-insights/oil-and-gas-after-covid-19-the-day-of-reckoning-or-a-new-age-of-opportunity (Accessed September 28, 2020)

Berck, P. (1995). Development of a Methodology to Assess the Economic Impact Required by SB 513/AB 969. Available at https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/93-314.pdf (Accessed September 23, 2020)

Bureau of Economic Analysis (BEA). (2020). Table 1.1.9. Implicit price deflators for Gross Domestic Product. March 26, 2020. Available at https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey (Accessed November 16, 2020)

Bureau of Labor Statistics (BLS). (2020). Quarterly Census of Employment and Wages (QCEW). Available at https://www.bls.gov/cew/downloadable-data-files.htm (Accessed September 17, 2020)

Cal. Gov't Code § 65040.12. Available at https://codes.findlaw.com/ca/government-code/gov-sect-65040-12.html (Accessed September 24, 2020)

California Air Resources Board (CARB). (2020). Facility Search. Available at https://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php?dd= (Accessed September 3, 2020)

California Central Valley Economic Development Corporation (CCVEDC). (2020). Incentives. Available at https://centralcalifornia.org/our-services/incentives/ (Accessed September 24, 2020)

California Code, Health and Safety Code - HSC §40728.5. Available at https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=3.&chapter=6.5.&article= (Accessed September 24, 2020)

California Employment Development Department (CA EDD). (2020b). Agricultural Employment in California. Available at https://www.labormarketinfo.edd.ca.gov/data/ca-agriculture.html (Accessed September 16, 2020)

California Employment Development Department (CAEDD). (2020a). Local Area Unemployment Statistics (LAUS), Annual Average. Available at https://data.edd.ca.gov/Labor-Force-and-Unemployment-Rates/Local-Area-Unemployment-Statistics-LAUS-Annual-Ave/7jbb-3rb8 (Accessed August 31, 2020)

California Office of Environmental Health Hazard Assessment (OEHHA). (2017). CalEnviroScreen 3.0. Update to the California Communities Environmental Health Screening Tool. January 2017. Available at https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf (Accessed November 10, 2020)

California Office of Environmental Health Hazard Assessment (OEHHA). (2018). CalEnviroScreen 3.0 (updated June 2018). Available at https://oehha.ca.gov/calenviroscreen/maps-data (Accessed September 3, 2020)

California Small Business Procurement and Contract Act (Cal. Gov't Code § 14837). Available at https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=14837.&lawCode=GOV (Accessed September 17, 2020)

Clouse, C. (2020). Using the Evolving Economy - COVID 2020 Q2 Data. IMPLAN Support Site, IMPLAN Group, LLC.

COVID19.ca.gov. (2020). Stay Home Order. Available at https://covid19.ca.gov/stay-home-except-for-essential-needs/#rsho-qas (Accessed December 7, 2020)

Demski, J. (2020). Modeling the Impact of the Coronavirus with Evolving Economy Data. IMPLAN Blog, IMPLAN Group, LLC. September 28, 2020.

ERA Economics LLC. (2020). Economic Impacts of the COVID-19 Pandemic on California Agriculture. Available at https://www.cfbf.com/wp-content/uploads/2020/06/COVID19_AgImpacts.pdf (Accessed September 28, 2020)

Flores, J. (2020). Nowhere to labor: The US oil industry, sapped by COVID-19, has lost hundreds of rigs in a 'historic and troubling' year. Available at https://www.usatoday.com/story/news/nation/2020/09/07/covid-19-us-oil-industry-wyoming-texas-baker-hughes/5735992002/ (Accessed September 28, 2020)

IMPLAN Group LLC. (2020a). Evolving Economy - COVID Q2-2020. Huntersville, NC. Available at https://www.implan.com/ (Accessed September 29, 2020)

IMPLAN Group LLC. (2020b). IMPLAN Citation Guidelines. Available at https://implan.com/citation-guidelines/ (Accessed October 1, 2020)

IMPLAN Group LLC. (2020c). Email to Eastern Research Group, Inc. (ERG) Re. Growth in the Oil and Gas Industry. November 16, 2020.

Internal Revenue Service (IRS). (2016). SOI Tax Stats - Corporation Source Book- Data File. . Available at https://www.irs.gov/statistics/soi-tax-stats-corporation-source-book-data-file (Accessed April 25, 2016)

Kasler, D. (2020). COVID-19 shutdown is crushing oil prices. Why this part of California isn't celebrating. Available at https://www.sacbee.com/article242153486.html (Accessed September 28, 2020)

League of California Cities. (2020). COVID-19: Fiscal Impact on California Cities. Available at https://www.cacities.org/Images/COVID19-Fiscal-Impact-on-CA-Cities-Infographic-FIN.aspx (Accessed October 13, 2020)

Ledbetter, K. (2020). Study: COVID-19 Economic Impact $2.5 Trillion Loss in Goods, Services. Available at https://www.agweb.com/article/study-covid-19-economic-impact-25-trillion-loss-goods-services (Accessed September 28, 2020)

Lillis, R. (2019). On the rise? The Central Valley is beating the Bay Area and L.A. in key measures Available at https://www.sacbee.com/news/california/big-valley/article223896300.html (Accessed September 24, 2020)

McCarthy, K. (2020). Oil & Gas: The Impact of COVID-19 and Oil Price Declines on Oil Sensitive Office Markets. Available at https://www.cushmanwakefield.com/en/insights/covid-19/oil-and-gas-impact-on-commercial-real-estate (Accessed September 28, 2020)

McNichol, E. & Leachman, M. (2020). States Continue to Face Large Shortfalls Due to COVID-19 Effects. Available at https://www.cbpp.org/research/state-budget-and-tax/states-continue-to-face-large-shortfalls-due-to-covid-19-effects (Accessed September 28, 2020)

National Association of Counties (NACo). (2020). Analysis of May Jobs Report and COVID-19 Impact on Local Government Job Loss. Available at https://www.naco.org/resources/analysis-may-jobs-report-and-covid-19-impact-local-government-jobs (Accessed September 28, 2020)

Office of Personnel Management (OPM). (2017). Profile of Federal Civilian Non-Postal Employees-September 30, 2017. Available at https://www.opm.gov/policy-data-oversight/data-analysis-documentation/federal-employment-reports/reports-publications/profile-of-federal-civilian-non-postal-employees/ (Accessed September 21, 2020)

Penson, J. (2020). The Economic Impact of COVID-19 on U.S. Agriculture. Available at https://agamerica.com/wp-content/uploads/2020/05/the-economic-impact-of-covid19-on-us-agriculture-whitepaper.pdf (Accessed September 28, 2020)

Risk Management Association (RMA). (2020). Annual Statement Studies. Available at https://www.rmahq.org/annual-statement-studies/ (Accessed October 13, 2020)

San Joaquin Valley Air Pollution Control District (SJVAPCD). (2013). Rule 4702 Internal Combustion Engines (Adopted August 21, 2003; Amended June 16, 2005; Amended April 20, 2006; Amended January 18, 2007; Amended August 18, 2011; Amended November 14, 2013) . Available at https://www.valleyair.org/rules/currntrules/R4702_Clean.pdf (Accessed September 23, 2020)

San Joaquin Valley Air Pollution Control District (SJVAPCD). (2020a). District Rule 4702 (Internal Combustion Engines). Presentation November 19, 2020. Available at

https://www.valleyair.org/Workshops/postings/2020/11-19-20_rules/presentation.pdf (Accessed November 30, 2020)

San Joaquin Valley Air Pollution Control District (SJVAPCD). (2020b). Facility Data Prepared for Eastern Research Group, Inc. (ERG). May 2020.

San Joaquin Valley Air Pollution Control District (SJVAPCD). (2020c). Cost Data Prepared for Eastern Research Group, Inc. (ERG). September 2020.

San Joaquin Valley Air Pollution Control District (SJVAPCD). (2020d). SIC Industry Groupings.

Sheehan, T. (2020). Gas prices plummet in Fresno, Valley as coronavirus sinks global demand for oil. Available at https://www.fresnobee.com/news/business/article241438721.html (Accessed September 28, 2020)

Sheiner, L. & Campbell, S. (2020). How much is COVID-19 hurting state and local revenues? Available at https://www.brookings.edu/blog/up-front/2020/09/24/how-much-is-covid-19-hurting-state-and-local-revenues/ (Accessed September 28, 2020)

U.S. Census Bureau. (2015). Statistics of U.S. Businesses - 2012 - States, 6-digit NAICS. Available at https://www.census.gov/programs-surveys/susb/data/datasets.2012.html (Accessed December 1, 2015)

U.S. Census Bureau. (2017a). State and local government employment and payroll data: March 2017. Available at https://www.census.gov/programs-surveys/cog/data/tables.All.html (Accessed July 7, 2020)

U.S. Census Bureau. (2017b). Government Units Survey. Available at https://www.census.gov/data/datasets/2017/econ/gus/public-use-files.html (Accessed July 6, 2020)

U.S. Census Bureau. (2019a). American Community Survey-Median Income in the Past 12 Months (In 2018 Inflation-Adjusted Dollars). Table ID: S1903. Available at https://data.census.gov/cedsci/table?q=S1903&text=S1903&tid=ACSST1Y2018.S1903&hidePreview=false (Accessed September 8, 2020)

U.S. Census Bureau. (2019b). Poverty Status in the Past 12 Months. Available at https://data.census.gov/cedsci/all?q=POVERTY%20STATUS%20IN%20THE%20PAST%2012%20MONTHS (Accessed September 8, 2020)

U.S. Census Bureau. (2020a). North American Industry Classification System - Concordances. Available at https://www.census.gov/eos/www/naics/concordances/concordances.html (Accessed September 2, 2020)

U.S. Census Bureau. (2020b). All Sectors: Summary Statistics for the U.S., States, and Selected Geographies 2017 (ECNBASIC2017). Revised June 2, 2020. Available at https://data.census.gov/cedsci/table?q=EC1771BASIC%20Summary%20Statistics%20for%20the

%20U.S.,%20States,%20and%20Selected%20Geographies%3A%202017&n=N0000.00&tid=ECNBASIC2017.EC1700BASIC&hidePreview=true (Accessed September 24, 2020)

U.S. Census Bureau. (2020c). Annual Survey of State and Local Government Finances - 2017 State & Local Government Finance Historical Tables. Revised April 3, 2020. Available at https://www.census.gov/data/tables/2017/econ/gov-finances/summary-tables.html (Accessed July 7, 2020)

U.S. Census Bureau. (2020d). County Population Totals: 2010-2019: Annual Estimates of the Resident Population for Counties: April 1, 2010 to July 1, 2019. Available at https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html#par_textimage_739801612 (Accessed September 8, 2020)

U.S. Department of Agriculture National Agricultural Statistics Service (NASS). (2019). Census of Agriculture-California-2017 Census Volume 1, Chapter 1: State Level Data. Issued April 2019. Available at https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/California/cav1.pdf (Accessed September 16, 2020)

USDA ERS. (2020). Farms and Farm Households During the COVID-19 Pandemic. Available at https://www.ers.usda.gov/covid-19/farms-and-farm-households/ (Accessed September 28, 2020)

Westhoff, P., Meyer, S., Binfield, J., and Gerlt, S. (2020). Early Estimates of the Impacts of COVID-19 on U.S. Agricultural Commodity Markets, Farm Income and Government Outlays. Available at https://www.fapri.missouri.edu/wp-content/uploads/2020/04/FAPRI-Report-02-20.pdf (Accessed September 28, 2020)

Yagova, O., George, L., Sharafedin, B. (2020). Coronavirus creates repair headache for oil and gas industry. Available at https://www.reuters.com/article/us-health-coronavirus-oil-maintenance-an/coronavirus-creates-repair-headache-for-oil-and-gas-industry-idUSKBN22V0LT (Accessed September 28, 2020)

APPENDIX A. SECTOR, SIC CODE, AND NAICS CODE CONCORDANCES

Table A-1 shows the concordance between SIC codes and sectors developed by SJV APCD (SJVAPCD, 2020d). (SIC codes that were not in this concordance but that might have indirect and induced impacts were assigned the sector "Other Industries.")

Table A-1. SIC Code to Sector Concordance used to Analyze the Impacts of Rule 4702—Internal Combustion Engines

SIC Code	SIC Industry	Sector
0115	Corn	Agriculture
0119	Cash Grains, NEC - Dry Pea and Bean Farms	Agriculture
0131	Cotton	Agriculture
0139	Field Crops, Except Cash Grains, NEC - Hay Farms	Agriculture
0161	Vegetables and Melons	Agriculture
0172	Grapes	Agriculture
0173	Tree Nuts	Agriculture
0174	Citrus Fruits - Orange Groves and Farms	Agriculture
0175	Deciduous Tree Fruits - Apple Orchards and Farms	Agriculture
0179	Fruits and Tree Nuts, NEC - Combination Fruit and Tree Nut Farms	Agriculture
0191	General Farms, Primarily Crop	Agriculture
0211	Beef Cattle Feedlots	Agriculture
0241	Dairy Farms - Dairy Heifer Replacement Farms	Agriculture
0251	Broiler, Fryers, and Roaster Chickens	Agriculture
0291	General Farms, Primarily Livestock and Animal Specialties	Agriculture
0721	Crop Planting, Cultivating, and Protecting	Agriculture
0723	Crop Preparation Services For Market, except Cotton Ginning - Other	Agriculture
1321	Natural Gas Liquids	Oil and Gas Production
4941	Water Supply	Water Supply and Storage
4952	Sewerage Systems	Wastewater Treatment
5093	Scrap and Waste Materials	Scrap and Waste Materials
9199	General Government, NEC	Water Supply and Storage

Source: SJVAPCD, 2020d.

Table A-2 shows the NAICS codes that map to the SIC codes used in the analysis (limited to the NAICS codes assigned to the facilities in the District that may be affected by the potential amendments). This concordance was primarily developed using the U.S. Census Bureau's (2020a) SIC to NAICS concordances. Where multiple NAICS codes map to one SIC code, ERG used information on companies' websites or other search tools about what type of industry they are engaged in to assign a NAICS code.

Table A-2. SIC to NAICS Concordance for Facilities that may be Affected by Potential Amendments to Rule 4702—Internal Combustion Engines

SIC Code	SIC Industry	Corresponding NAICS
0115	Corn	1111 (Oilseed and Grain Farming)
0119	Cash Grains, NEC - Dry Pea and Bean Farms	1111 (Oilseed and Grain Farming)
0131	Cotton	1119 (Other Crop Farming)
0139	Field Crops, Except Cash Grains, NEC - Hay Farms	1112 (Vegetable and Melon Farming), 1121 (Cattle Ranching and Farming)
0161	Vegetables and Melons	1112 (Vegetable and Melon Farming)
0172	Grapes	1113 (Fruit and Tree Nut Farming)
0173	Tree Nuts	1113 (Fruit and Tree Nut Farming)
0174	Citrus Fruits - Orange Groves and Farms	1113 (Fruit and Tree Nut Farming)
0179	Fruits and Tree Nuts, NEC - Combination Fruit and Tree Nut Farms	1113 (Fruit and Tree Nut Farming)
0191	General Farms, Primarily Crop	1119 (Other Crop Farming)
0211	Sheep and Goats	1121 (Cattle Ranching and Farming)
0241	Dairy Farms - Dairy Heifer Replacement Farms	1121 (Cattle Ranching and Farming)
0251	Broiler, Fryers, and Roaster Chickens	1121 (Cattle Ranching and Farming)
0291	General Farms, Primarily Livestock and Animal Specialties	1129 (Other Animal Production)
0721	Crop Planting, Cultivating, and Protecting	1151 (Support Activities for Crop Production)
1321	Natural Gas Liquids	2111 (Oil and Gas Extraction)
4941	Water Supply	9993 (Local Government)
4952	Sewerage Systems	9993 (Local Government)
5093	Scrap and Waste Materials	5629 (Remediation and Other Waste Management Services)
9199	General Government, NEC	9993 (Local Government)

Source: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2020a.

APPENDIX B. PROFIT RATES BY NAICS INDUSTRY

Table B-1 shows the profit rates used for non-agricultural private industry NAICS codes, which were estimated using the average rate for 2000 through 2013 data from the Internal Revenue Service (IRS, 2016) "SOI Tax Stats - Corporation Source Book."

Table B-1. Profit Rate by NAICS Industry for Facilities Affected by Rule 4702—Internal Combustion Engines

NAICS	Industry	Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1151	Support Activities for Crop Production	2.00%	1.04%	0.92%	-0.49%	1.06%	1.89%	3.36%	2.06%	2.84%	0.48%	0.87%	2.64%	2.33%	4.76%	4.31%
2111	Oil and Gas Extraction	7.33%	6.53%	5.55%	0.85%	5.50%	8.04%	14.89%	16.06%	11.11%	10.31%	2.50%	8.29%	5.99%	3.50%	3.50%
5629	Remediation and Other Waste Management Services	3.47%	1.83%	2.78%	1.49%	-0.78%	3.05%	5.19%	-1.57%	6.69%	4.14%	6.25%	6.27%	4.23%	4.92%	4.13%
9993	Local Government	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: ERG estimates based on IRS, 2016.

Note: Profit rate calculated as "Net Income (less deficit)" divided by "Total Receipts."

APPENDIX C. COVID-19 BASELINE ADJUSTMENTS BY NAICS INDUSTRY

Table C-1 shows the percentage change in revenue, employment, and average pay per employee by NAICS code, derived by comparing IMPLAN's (2020a) datasets for 2018 and the "Evolving Economy" dataset developed using data for the second quarter of 2020.

Table C-1. COVID-19 Adjustments by NAICS Industry for Facilities Affected by Rule 4702—Internal Combustion Engines

NAICS	Industry	COVID-19-Adjusted Change in Baseline		
		Revenue	Employment	Average Pay
1111	Oilseed and Grain Farming	-17.47%	-14.09%	13.85%
1112	Vegetable and Melon Farming	-17.46%	-13.79%	13.98%
1113	Fruit and Tree Nut Farming	-17.46%	-12.71%	13.90%
1119	Other Crop Farming	-17.46%	-14.86%	13.76%
1121	Cattle Ranching and Farming	-17.46%	-16.08%	13.78%
1129	Other Animal Production	-14.66%	-14.12%	13.74%
1151	Support Activities for Crop Production	-32.19%	-13.91%	13.78%
2111	Oil and Gas Extraction	33.55%	29.86%	6.47%
5629	Remediation and Other Waste Management Services	9.90%	3.37%	7.41%
9993	Local Government	9.59%	4.86%	5.84%

Source: ERG estimates based on IMPLAN, 2020a.

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APPENDIX E

Rule Consistency Analysis
For Proposed Amendments to Rule 4702

August 19, 2021

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RULE CONSISTENCY ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4702

I. REQUIREMENTS FOR RULE CONSISTENCY ANALYSIS

Pursuant to Section 40727.2 of the California Health and Safety Code, prior to adopting, amending, or repealing a rule or regulation, the District performs a written analysis that identifies and compares the air pollution control elements of the rule or regulation with corresponding elements of existing or proposed District and United States Environmental Protection Agency (EPA) rules, regulations, and guidelines that apply to the same source category. The rule elements analyzed are emission limits; monitoring and testing requirements; recordkeeping and reporting requirements; and operating parameters and work practice requirements.

II. ANALYSIS

A. District Rules

Facilities could be subject to other District rules including:

- Rule 1070 Inspections
- Rule 1081 Source sampling
- Rule 1100 Equipment Breakdown
- Rule 2010 Permits Required
- Rule 2201 New and Modified Stationary Source Review Rule
- Rule 2250 Permit-Exempt Equipment Registration
- Rule 2520 Federally Mandated Operating Permits
- Rule 4001 New Source Performance Standards
- Rule 4101 Visible Emissions
- Rule 4102 Nuisance
- Rule 4201 Particulate Matter Concentration
- Rule 4701 Internal Combustion Engines – Phase 1
- Rule 4801 Sulfur Compounds

The above-listed rules are not in conflict with, nor are they inconsistent with the requirements of Proposed Rule 4702.

B. Federal Rules, Regulations, and Policies

1. EPA Control Techniques Guideline (CTG) Document

Based on the EPA "Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone-Causing Emissions" document[1], there are no EPA CTGs applicable to this source category and, therefore, no conflicts or inconsistencies with the proposed requirements of Rule 4702.

2. EPA Alternative Control Techniques (ACT) Document

NOx Emissions from Stationary Reciprocating Internal Combustion Engines (EPA – 453/R-93-032, July 1993)

The EPA Alternative Control Techniques (ACT) document – NOx Emissions from Stationary Reciprocating Internal Combustion Engines (EPA – 453/R-93-032, July 1993) applies to stationary combustion engines. The ACT document provides technical information for use by State and local agencies to develop and implement regulatory programs to control NOx emissions from stationary reciprocating engines; however, the ACT does not recommend specific emission limits. There are no conflicts or inconsistencies with the proposed requirements of Rule 4702.

3. EPA New Source Performance Standard (NSPS)

40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

The New Source Performance Standards (NSPS) of 40 CFR 60 Subpart IIII apply to stationary compression-ignition IC engines. 40 CFR 60 Subpart IIII establishes emission certification requirements for manufacturers of stationary compression-ignition IC engines. 40 CFR 60, Subpart IIII also establishes emission requirements for owners and operators of compression-ignition IC engines for which construction commenced after July 11, 2005 and the engine was manufactured after April 1, 2006 for engines that are not fire pump engines and for owners and operators of compression-ignition IC engines for which construction commenced after July 11, 2005 and the engine was manufactured after July 1, 2006 for engines that were manufactured as certified National Fire Protection Association (NFPA) fire pump engines after July 1, 2006.

[1] Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone-Causing Emissions. (2016). Retrieved December 8, 2020 from https://www.epa.gov/ground-level-ozone-pollution/control-techniques-guidelines-and-alternative-control-techniques

The District evaluated the requirements of 40 CFR 60 Subpart IIII and determined that there are no conflicts or inconsistencies with the proposed requirements of Rule 4702.

40 CFR 60 Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

The NSPS of 40 CFR 60 Subpart JJJJ apply to stationary spark-ignition IC engines. 40 CFR 60 Subpart JJJJ establishes emission requirements for manufacturers of stationary spark-ignition IC engines. 40 CFR 60 Subpart JJJJ also establishes emission requirements for owners and operators of stationary spark ignition IC engines that commence construction after June 12, 2006 where the IC engines are manufactured: on or after July 1, 2007 for engines with a maximum rated power greater than or equal to 500 bhp, except lean-burn engines with a maximum engine power greater than or equal to 500 bhp and less than 1,350 bhp; on or after January 1, 2008, for lean-burn engines with a maximum rated power greater than or equal to 500 bhp and less than 1,350 bhp; on or after July 1, 2008, for engines with a maximum rated power less than 500 bhp; or on or after January 1, 2009, for emergency engines with a maximum rated power greater than 19 kW (25 bhp).

The District evaluated the requirements of 40 CFR 60 Subpart JJJJ and determined that there are no conflicts or inconsistencies with the proposed requirements of Rule 4702.

4. National Emission Standard for Hazardous Air Pollutants (NESHAP)

40 CFR 61 (NESHAP) does not include a NESHAP standard for IC engines.

5. National Emission Standard for Hazardous Air Pollutants (NESHAP) for Source Categories (Maximum Achievable Control Technology)

40 CFR 63 Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR 63 Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAPs) emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. As defined in 40 CFR 63 Subpart ZZZZ, a major source of HAP emissions is a facility that has the potential to emit any single HAP at a rate of 10 tons per year or greater or any combinations of HAPs at a rate of 25 tons per year or greater and an area source of HAPs is a facility is not a major source of HAPs. 40 CFR 63 Subpart ZZZZ applies to owners and operators of stationary reciprocating internal combustion engines, except if the

reciprocating internal combustion engine is being tested at a stationary IC engine test cell/stand. Existing IC engines must comply with the emission requirements, operation limits, and management practices of this regulation. In general, new or reconstructed stationary reciprocating internal combustion engines comply with 40 CFR 63 Subpart ZZZZ by complying with the applicable requirements of 40 CFR 60 Subpart IIII or 40 CFR 60 Subpart JJJJ.

The District evaluated the requirements of 40 CFR 63 Subpart ZZZZ and determined that there are no conflicts or inconsistencies with the proposed requirements of Rule 4702.

6. EPA Best Available Control Technology (BACT) Requirements

EPA maintains a database that contains Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) technologies that have been provided to EPA by state and local permitting agencies.[2] Based on review of recent determinations for stationary IC engines in the EPA RACT/BACT/LAER Clearinghouse (RBLC) the proposed requirements of Rule 4702 will not conflict with units subject to EPA BACT or LAER requirements.

7. EPA Policy on Recordkeeping

The recordkeeping requirement in Rule 4702 is consistent with EPA's policy to keep and maintain records for at least five years.

III. CONCLUSION

Based on the above analysis, District staff found that the proposed amendments to Rule 4702 would not conflict with any District or federal rules, regulations, or policies covering similar stationary sources.

[2] Environmental Protection Agency [EPA]: Clean Air Technology Center - RACT/BACT/LAER Clearinghouse. https://cfpub.epa.gov/rblc/index.cfm?action=Home.Home

APPENDIX F

Reasonably Available Control Technology (RACT) and Best Available Retrofit Control Technology (BARCT) Analyses For Proposed Amendments to Rule 4702

August 19, 2021

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I. BACKGROUND:

Sections 182(b)(2) and 182(f) of the federal Clean Air Act require ozone nonattainment areas to implement RACT for sources that are subject to Control Techniques Guidelines (CTG) documents issued by EPA and for "major sources" of VOCs and NOx, which are ozone precursors. RACT can be defined as devices, systems, process modifications, or other apparatus or techniques that are reasonably available, taking into account the necessity of imposing such controls in order to attain and maintain a national ambient air quality standard (NAAQS); the social, environmental, and economic impact of such controls; and alternative means of providing for attainment and maintenance of such a standard. These control techniques, which are defined in EPA guidelines for limiting emissions from existing sources in nonattainment areas, are adopted and implemented for nonattainment areas by state analysis.

In November 2015, EPA published the Technical Support Document (TSD)[1] for the current version of Rule 4702 in conjunction with EPA's full approval of the rule for inclusion into the State Implementation Plan (SIP). As published in the Federal Register, EPA determined that the requirements of Rule 4702, to be, "consistent with EPA regulations, and relevant policy and guidance regarding enforceability, BACM/BACT, RACM/RACT, and SIP relaxations." [2] The TSD published in November 2015 for *EPA's Proposed Rulemaking for the California State Implementation Plan - San Joaquin Valley Unified Air Pollution Control District Rule 4702 Internal Combustion Engines* states "The submitted Rule 4702 strengthens the SIP… For the reasons discussed above, we propose to find that the emission limits in Table 1, Table 3, and Table 4 of Rule 4702 and related compliance requirements implement BACM for this source category at this time."[3] Additionally, on November 15, 2018, the District adopted the District's 2018 Plan for the 1997, 2006, and 2012 PM2.5 ambient air quality standards to satisfy the Clean Air Act (CAA) requirements for these standards. As a part of the 2018 PM2.5 Plan, the District demonstrated that Rule 4702 continued to satisfy BACM and performed a Most Stringent Measures (MSM) analysis for all rules that contain emission limits or requirements for NOx or PM. EPA defines MSM as, "*the maximum degree of emission reductions that has been required or achieved from a source or source category in any other attainment plans or in practice in any other states and that can feasibly be implemented in the area.*" MSM is addressed on a pollutant-by-pollutant basis and is more stringent than RACT and BARCT. In the Technical Support Document - EPA Evaluation of BACM/MSM, San Joaquin Valley

[1] Technical Support Document for EPA's Notice of Proposed Rulemaking and Direct Final Rule for the California State Implementation Plan – San Joaquin Valley Unified Air Pollution Control District Rule 4702 (Internal Combustion Engine) November 2015.

[2] Revisions to the California State Implementation Plan, San Joaquin Valley Air Pollution Control District and Sacramento Metropolitan Air Quality management District, 73 Fed. Reg. 7, pp. 1818 – 1822. (2008, January 10).

[3] Technical Support Document for EPA's Proposed Rulemaking for the California State Implementation Plan - San Joaquin Valley Unified Air Pollution Control District Rule 4702 Internal Combustion Engines. (November 2015).

PM2.5 Plan for the 2006 PM2.5 NAAQS[4] (February 2020), EPA also determined that Rule 4702 implemented BACM and MSM for IC engines.

As discussed above, EPA has determined that the requirements of Rule 4702 satisfy MSM and BACM (Best Available Control Measures)/BACT (Best Available Control Technology), which are a higher level of control than RACT. Since the full approval of the current version of Rule 4702 by EPA, emissions control technology for stationary internal combustion engines has not changed significantly; therefore, the proposed amendments to Rule 4702 to make existing emissions limitations more stringent will clearly continue to exceed RACT.

II. Best Available Retrofit Control Technology (BARCT) Requirements

Most existing stationary sources in California non-attainment areas, such as the San Joaquin Valley, have been subject to Best Available Retrofit Control Technology (BARCT) requirements since the 1980s. California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[5], Non-vehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. One requirement of AB 617 is for California air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements by no later than December 31, 2023. AB 617 requires the expedited BARCT implementation schedule to apply to each industrial source that, as of January 1, 2017, was subject to the Cap-and-Trade program and gives the highest priority to those permitted units that have not modified emissions-related permit conditions for the greatest period of time. AB 617 also recognizes that "Existing law also authorizes a district to establish its own best available retrofit control technology requirement based upon the consideration of specified factors."

As discussed above, the District and EPA have determined that the current requirements of Rule 4702 satisfy MSM and BACM/BACT for NOx and PM precursors, which require a more stringent level of control than BARCT; therefore, the current Rule 4702 emission limits for NOx and PM precursors also satisfy BARCT requirements.

[4] Technical Support Document - EPA Evaluation of BACM/MSM, San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS (February 2020)
[5] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

As stated above, AB 617 requires air districts located in non-attainment areas to perform a BARCT analysis of their existing rules and regulations. Because the San Joaquin Valley Air District is classified as attainment for SOx and CO, a BARCT analysis is not required for these pollutants. Therefore, the BARCT analysis for Rule 4702 was limited to evaluating the VOC emission limits and requirements included the rule.

The District is proposing to amend Rule 4702 to establish a VOC limit of 90 ppmv @ 15% O2 (referenced as methane) for all spark-ignited IC engines subject to the rule requirements. This VOC emission limit was selected because it represents a well-controlled level that can be achieved without adversely impacting the ability of affected IC engines to achieve the NOx emissions reductions required by the rule. The proposed 90 ppmv VOC limit will significantly reduce the current VOC emission limits in Rule 4702 of 250 ppmv for rich-burn IC engines and 750 ppmv for lean-burn IC engines and, as discussed below, will be considerably lower than the VOC limits contained in the rules of almost all other California air districts that apply to IC engines.

A. OTHER AIR DISTRICTS

To ensure that the proposed VOC emission limits in Rule 4702 satisfy BARCT, the District compared the proposed emission limits to the requirements of other rules and regulations that apply to IC engines in other California air districts, and also considered applicable State regulations and Federal New Source Performance Standards for IC engines.

The requirements of the following rules and regulations were compared to the proposed VOC limits in Rule 4702 to ensure that the proposed VOC limits satisfy BARCT.

- California Environmental Protection Agency Air Resources Board Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines (November 2001)
- Antelope Valley AQMD Rule 1110.2 - Emissions from Stationary, Non-Road and Portable Internal Combustion Engines (9/18/2018)
- Bay Area AQMD Regulation 9, Rule 8 – Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines (7/25/2007)
- Feather River AQMD Rule 3.22 – Stationary Internal Combustion Engines (8/3/20)
- Mojave Desert AQMD Rule 1160 - Internal Combustion Engines (1/22/2018)
- Sacramento Metropolitan AQMD Rule 412 – Stationary Internal Combustion Engines at Major Stationary Sources of NOx (6/1/1995)
- South Coast AQMD Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Engines (11/1/2019)
- Ventura County APCD Rule 74.9 – Stationary Internal Combustion Engines (11/8/2005)

- 40 CFR 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
- 40 CFR 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

The applicable VOC requirements of the regulations listed above are summarized below.

- *California Environmental Protection Agency Air Resources Board Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines (November 2001)*

This document presents CARB's determination of RACT and BARCT for NOx, VOC, and CO emissions from stationary, non-emergency, spark-ignited, reciprocating IC engines with a rated power of 50 bhp or greater. The RACT and BARCT determination was developed by CARB staff and representatives of California air districts. There have been no updates to this determination since it was adopted.

This document indicates that CARB determined that VOC limits of 250 ppmv @ 15% O2 and 750 ppmv @ 15% O2 were BARCT for rich-burn spark-ignited IC engines and lean-burn spark-ignited IC engines IC engines, respectively. The 90 ppmv @ 15% O2 VOC limit for spark-ignited IC engines included in the proposed amendments to Rule 4702 is significantly lower than the BARCT limits given in this document.

- *Antelope Valley AQMD (AVAQMD) Rule 1110.2 - Emissions from Stationary, Non-Road and Portable Internal Combustion Engines (9/18/2018)*

The stated purpose of this rule is to limit emissions of NOx, VOCs, and CO from IC Engines. This rule was last amended on September 18, 2018. The AVAQMD Rule & Plan Development webpage and 2021 Rule Development List indicate that AVAQMD currently does not have any plans to amend this rule.[6]

AVAQMD Rule 1110.2 requires stationary spark-ignited IC engines to comply with a VOC limit of 250 ppmv @ 15% O2 and requires portable spark-ignited IC engines to comply with a VOC limit of 240 ppmv @ 15% O2.

The 90 ppmv @ 15% O2 VOC limit for spark-ignited IC engines included in the proposed amendments to Rule 4702 is significantly lower than the VOC limits in this rule.

- *Bay Area AQMD (BAAQMD) Regulation 9, Rule 8 – Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines (7/25/2007)*

[6] https://avaqmd.ca.gov/rule-plan-development

The purpose of BAAQMMD Regulation 9, Rule 8 is to limit the emissions of NOx and CO from stationary internal combustion engines with an output rated by the manufacturer at more than 50 brake horsepower. The BAAQMD Rule Development webpage[7] and the BAAQMD Industrial Cap-and-Trade Sources Expedited BARCT Implementation Schedule Final Staff Report[8] indicate that BAAQMD currently does not have any plans to amend this rule.

This rule does not include any limits for VOC emissions from IC engines. Therefore, no discussion of this rule is required.

- *Feather River AQMD (FRAQMD) Rule 3.22 – Stationary Internal Combustion Engines (8/3/20)*

FRAQMD Rule 3.22 applies to stationary IC engines with rated brake horsepower greater than or equal to fifty (>50 bhp) used in industrial, institutional, and commercial operations that operate within the boundaries of the FRAQMD. Agricultural engines at agricultural sources that emit air emissions less than 50% of the major source thresholds for regulated air pollutants and/or HAPs in any 12-month period are exempt from this rule.

FRAQMD Rule 3.22 was last amended on August 3, 2020. The 2020 amendments to FRAQMD Rule 3.22 were required by the FRAQMD Proposed Expedited BARCT Schedule for Industrial Facilities Subject to Cap and Trade in order to address BARCT requirements for NOx, VOC, and CO emissions from IC engines.[9]

FRAQMD Rule 3.22 requires stationary spark-ignited rich-burn IC engines to comply with a VOC limit of 250 ppmv @ 15% O2 and requires stationary spark-ignited lean-burn IC engines and stationary compression-ignited IC engines to comply with a VOC limit of 750 ppmv @ 15% O2. FRAQMD determined that the NOx, VOC, and CO emission limits included in the rule for spark-ignited IC engines satisfy BARCT.[10]

The 90 ppmv @ 15% O2 VOC limit for spark-ignited IC engines included in the proposed amendments to Rule 4702 is significantly lower than the VOC limits in this

[7] https://www.baaqmd.gov/rules-and-compliance/rule-development
[8] Bay Area Air Quality Management District Industrial Cap-and-Trade Sources Expedited BARCT Implementation Schedule Final Staff Report (December 2018) https://www.baaqmd.gov/~/media/files/ab617-community-health/barct/20181214_fsr_ab617_barct-pdf.pdf?la=en
[9] Feather River Air Quality Management District Proposed Expedited BARCT Schedule for Industrial Facilities Subject to Cap and Trade (December 2018) https://www.fraqmd.org/files/6df1834e6/Expedited+BARCT+Schedule.pdf
[10] Feather River Air Quality Management District Approval of Regulation III, Rule 3.22 - Stationary Internal Combustion Engines (8/3/2020) https://www.fraqmd.org/files/c0a94165c/Item+5+Resolution+2020-07+Rule+3.22+Adoption.pdf

rule, which FRAQMD recently determined satisfy BARCT. The Rule 4702 requirements for compression-ignition IC engines to be Tier 3 or Tier 4 are also more stringent than the VOC emission requirements for compression-ignition IC engines in FRAQMD.

- *Mojave Desert AQMD (MDAQMD) Rule 1160 - Internal Combustion Engines (1/22/2018)*

The purpose of MDAQMD Rule 1160 is to limit emissions of NOx, CO, and VOC from IC engines that are not subject to District Rule 1160.1 – Internal Combustion Engines in Agricultural Operations. MDAQMD Rule 1160 applies to stationary IC engines rated at 50 or more brake horsepower (bhp), when located within the MDAQMD Federal Ozone Non-attainment Area. MDAQMD Rule 1160 was last amended on January 22, 2018. The MDAQMD 2021 Rule Development Calendar [11] and the MDAQMD AB 617 BARCT Implementation Schedule [12] indicate that MDAQMD currently does not have any plans to amend this rule.

MDAQMD Rule 1160 requires stationary spark-ignited rich-burn IC engines, stationary spark-ignited lean-burn IC engines, and stationary compression-ignited IC engines to comply with a VOC limit of 106 ppmv @ 15% O2, except for stationary IC engines located at the Southern California Gas, Newberry Springs Facility, which must comply with a VOC limit of 255 ppmv @ 15% O2.

The VOC limits included in the proposed amendments to Rule 4702 are lower than the VOC limits in this rule and significantly lower than the VOC limits in the rule for stationary IC engines located at the Southern California Gas, Newberry Springs Facility.

- *Sacramento Metropolitan AQMD (SMAQMD) Rule 412 – Stationary Internal Combustion Engines at Major Stationary Sources of NOx (6/1/1995)*

The purpose of SMAQMD Rule 412 is to limit emissions of NOx, CO, and non-methane hydrocarbons (NMHC) from the operation of stationary IC engines located at major stationary sources of NOx that have a potential to emit for NOx exceeding 25 tons per year. SMAQMD Rule 412 was adopted June 1, 1995 and has not been amended. The SMAQMD Expedited BARCT Implementation Schedule for AB 617 [13] indicates that SMAQMD Rule 412 may be amended in 2022 to ensure that the rule satisfies the

[11] MDAQMD Rule Development Calendar 2021
https://www.mdaqmd.ca.gov/home/showpublisheddocument/8579/637441416419300000
[12] Mojave Desert AQMD AB 617 BARCT Implementation Schedule (2019)
https://www.mdaqmd.ca.gov/home/showdocument?id=6098
[13] Sacramento Metropolitan AQMD Expedited BARCT Implementation Schedule for Assembly Bill 617 (October 2018)
http://www.airquality.org/ProgramCoordination/Documents/Item1_102518_AB617_BARCT_Schedule.pdf

BARCT requirement for NOx from IC engines.[14] At this time SMAQMD has not held any workshops to discuss potential amendments to the rule.

SMAQMD Rule 412, Section 302 – BARCT Emission Limits requires stationary spark-ignited rich-burn IC engines subject to the rule to comply with a NMHC limit of 250 ppmv @ 15% O2 and requires stationary spark-ignited lean-burn IC engines and stationary compression-ignited IC engines subject to the rule comply with a NMHC limit of 750 ppmv @ 15% O2.

The VOC limits included in the proposed amendments to Rule 4702 are significantly lower than the NMHC limits in this rule. In addition, the emission requirements of Rule 4702 are also significantly more stringent in terms of applicability. With the exception of emergency IC engines and low-use IC engines that are infrequently used, stationary IC engines rated greater than 50 bhp and transportable IC engines rated greater than 50 bhp at stationary sources in the San Joaquin Valley are generally subject to the requirements of Rule 4702, while the SMAQMD Demonstration of Reasonably Available Control Technology for the 2008 Ozone NAAQS (RACT SIP) (January 23, 2017)[15] indicates that there were only five lean-burn, spark-ignited, IC engines subject to SMAQMD Rule 412.

- *South Coast AQMD (SCAQMD) Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Engines (11/1/2019)*

SCAQMD Rule 1110.2 applies to stationary and portable IC engines rated more than 50 bhp. The purpose of SCAQMD Rule 1110.2 is to reduce NOx, VOC, and CO emissions from IC engines. SCAQMD Rule 1110.2 was last amended on November 1, 2019. The 2019 amendments to SCAQMD Rule 1110.2 required IC engines that are in SCAQMD's Regional Clean Air Incentives Market (RECLAIM) and currently exempt from the NOx emission limits in the rule to comply with these emission limits in accordance with the schedule established in SCAQMD Rule 1100 – Implementation Schedule for NOx Facilities.[16] SCAQMD determined that no changes were needed for the existing NOx, VOC, and CO emission limits in the rule to satisfy BARCT.

SCAQMD Rule 1110.2 limits VOC emissions from most stationary IC engines to no more than 30 ppmv @ 15% O2. SCAQMD Rule 1110.2 also includes limits as low as

[14] Sacramento Metropolitan AQMD Expedited BARCT Implementation Schedule for Assembly Bill 617 (October 2018) http://www.airquality.org/ProgramCoordination/Documents/Item1_102518_AB617_BARCT_Schedule.pdf

[15] Sacramento Metropolitan Air Quality Management District Demonstration of Reasonably Available Control Technology for the 2008 Ozone NAAQS (RACT SIP) (January 23, 2017), http://www.airquality.org/ProgramCoordination/Documents/RACT%20SIP%20RactSipReport%20032317%20Item%204.pdf

[16] South Coast AQMD Final Subsequent Environmental Assessment and Amend Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Engines and Rule 1100 – Implementation Schedule for NOx Facilities (November 1, 2019) http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2019/2019-nov1-028.pdf?sfvrsn=6

10 ppmv VOC @ 15% O2 for new non-emergency IC engines powering electrical-generators. The SCAQMD Rule 1110.2 emission limits for new non-emergency IC engines powering electrical-generators do not apply to existing IC engines. SCAQMD has determined that the current stringent emission limits in SCAQMD Rule 1110.2 are equivalent to the Best Available Control Technology (BACT) requirements of New Source Review[17] and also previously determined that the current emission requirements of SCAQMD Rule 1110.2 satisfied Lowest Achievable Emission Rate (LAER) requirements of Federal NSR for a digester gas-fired IC engine.[18] A comparison of BACT requirements for VOC from IC engines in other California air Districts further supports that the VOC limits in SCAQMD Rule 1110.2 are at levels equivalent to BACT. For example, the District's previous BACT guideline for fossil fuel-fired IC engines (District BACT Guideline 3.3.12) identified 25 ppmv VOC @ 15% O2 as achieved in practice BACT for spark-ignited fossil fuel-fired IC engines. SMAQMD had also identified 25 ppmv VOC @ 15% O2 as achieved in practice BACT for spark-ignited IC engines, excluding biogas fueled engines and electrical generating engines,[19] and BAAQMD identifies 25 ppmv VOC @ 15% O2 as achieved in practice BACT for rich-burn natural gas-fired IC engines and 32 ppmv VOC @ 15% O2 as achieved in practice BACT for lean-burn natural gas-fired IC engines.[20] The SCAQMD determinations that the SCAQMD Rule 1110.2 VOC emission limits are equivalent to BACT and LAER and the comparison of these limits to the BACT requirements for VOC from IC engines in other California air districts make it clear that the VOC emission limits of SCAQMD Rule 1110.2 go beyond what is required for BARCT.

In addition, when considering low VOC emission limits for IC engines the potential adverse impact on the ability to comply with low NOx limits must be considered. The majority of spark-ignited IC engines that are subject to Rule 4702 are rich-burn IC engines that utilize NSCR to comply with the rule limits. When using NSCR systems to reduce emissions, an air-fuel ratio controller and oxygen sensor are used to precisely control the amount of oxygen in the engine's exhaust so that the NSCR system

[17] South Coast Air Quality Management District Best Available Control Technology Guidelines (February 1, 2019), Part D: BACT Guidelines for Non-Major Polluting Facilities, I.C. Engine, Stationary, Non-Emergency, Non-Electrical Generators and I.C. Engine, Stationary, Non-Emergency, Electrical Generators, http://www.aqmd.gov/docs/default-source/bact/bact-guidelines/part-d---bact-guidelines-for-non-major-polluting-facilities.pdf

[18] South Coast Air Quality Management District Best Available Control Technology Guidelines (February 2, 2018), Part B: LAER/BACT Determinations for Major Polluting Facilities, Section I - South Coast AQMD LAER/BACT Determinations, Application No. 546360, I.C. Engine, Digester Gas Fired (April 4, 2017), http://www.aqmd.gov/docs/default-source/bact/laer-bact-determinations/aqmd-laer-bact/2-2-18_laer_ocsd_biogasice.pdf?sfvrsn=12

[19] Sacramento Metropolitan Air Quality Management District BACT Clearinghouse (Last updated May 7, 2020), BACT Determination Number 143, IC Engine Prime Power http://www.airquality.org/businesses/permits-registration-programs/best-available-control-technology-(bact)

[20] Bay Area Air Quality Management District BACT/TBACT Workbook Section 2, Internal Combustion Engines, I. C. Engine - Spark Ignition, Natural Gas Fired Rich Burn Engine (May 7, 2003) and I. C. Engine - Spark Ignition, Natural Gas Fired Lean Burn Engine (May 7, 2003) https://www.baaqmd.gov/~/media/files/engineering/bact-tbact-workshop/combustion/96-3-2.pdf?la=en https://www.baaqmd.gov/~/media/files/engineering/bact-tbact-workshop/combustion/96-3-3.pdf?la=en

achieves optimal emissions control. The amount of oxygen present in the exhaust affects the ability of the system to reduce NOx and VOC in different ways. Less oxygen in the exhaust will result in lower NOx emissions, but emissions of VOCs and CO will increase because there is not sufficient oxygen to completely oxidize these compounds. Conversely, increased oxygen in the exhaust will reduce VOC and CO emissions, but can significantly increase NOx emissions as more nitrogen compounds are oxidized to form NOx across the catalyst. This tradeoff between NOx and VOC reductions makes it more difficult and expensive to simultaneously achieve low NOx and low VOC emissions. In the San Joaquin Valley air basin, NOx reductions are critical for air quality improvement strategies, while VOC reductions have a much more limited impact on air quality. Therefore, the District's attainment strategies and plans have prioritized NOx reductions over VOC reductions. As mentioned above, BARCT must take into account the "*environmental, energy and economic impacts"* of the source category. Considering the minimal effect that VOC reductions have on air quality improvements in the San Joaquin Valley and the much greater importance of NOx reductions, the SCAQMD Rule 1110.2 VOC emission limit, which is equivalent to BACT as determined by the SCAQMD, is beyond BARCT in the San Joaquin Valley.

- *Ventura County APCD (VCAPCD) Rule 74.9 – Stationary Internal Combustion Engines (11/8/2005)*

VCAPCD Rule 74.9 applies to stationary spark-ignited and diesel internal combustion engines rated at 50 bhp or more, operated on any gaseous fuel, including liquid petroleum gas (LPG), or liquid fuel, and not subject to the provisions of VCAPCD Rule 74.16 – Oilfield Drilling Operations. VCAPCD Rule 74.9 was last amended November 8, 2005. The VCAPCD Rule Development webpage [21] and the VCAPCD BARCT Rule Development Schedule 2019 through 2023[22] indicate that VCAPCD currently does not have any plans to amend this rule.

VCAPCD Rule 74.9 requires stationary spark-ignited rich-burn IC engines subject to the rule to comply with a Reactive Organic Compound (ROC)/VOC limit of 250 ppmv @ 15% O2 and requires stationary spark-ignited lean-burn IC engines and stationary diesel IC engines subject to the rule comply with an ROC limit of 750 ppmv @ 15% O2.

The VOC limits included in the proposed amendments to Rule 4702 are significantly lower than the ROC limits in this rule.

- *40 CFR 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*

[21] http://www.vcapcd.org/rules_division.htm

[22] Ventura County Air Pollution Control District Best Available Retrofit Control Technology Rule Development Schedule 2019 through 2023 (12/11/2018) http://www.vcapcd.org/pubs/Program/AB-617-Attachment-1-BARCT-Rule-Development-Schedule-V2.pdf

The New Source Performance Standards (NSPS) of 40 CFR 60 Subpart IIII establishes emission certification requirements for manufacturers of stationary compression-ignition IC engines. 40 CFR 60 Subpart IIII also establishes emission requirements for owners and operators of compression-ignition IC engines for which construction commenced after July 11, 2005 and the engine was manufactured after April 1, 2006 for engines that are not fire pump engines and for owners and operators of compression-ignition IC engines for which construction commenced after July 11, 2005 and the engine was manufactured after July 1, 2006 for engines that were manufactured as certified National Fire Protection Association (NFPA) fire pump engines after July 1, 2006.

40 CFR 60 Subpart IIII requires manufacturers of stationary compression-ignition IC engines to certify that the engines they produce comply with the applicable Tier standards for the engine model year and prohibits owners and operators of stationary compression-ignition IC engines from installing non-emergency IC engines that do not comply with the applicable tier emission standards beginning two years after the applicable emission standard came into effect. The Rule 4702 requirement that non-emergency compression-ignition engines be certified to the applicable Tier standard in effect at the time of installation is equivalent to the emission requirements for stationary non-emergency compression-ignition IC engines in 40 CFR 60 Subpart IIII.

- *40 CFR 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*

40 CFR 60 Subpart JJJJ establishes emission requirements for manufacturers of stationary spark ignition IC engines. 40 CFR 60 Subpart JJJJ also establishes emission requirements for owners and operators of stationary spark ignition IC engines that commence construction after June 12, 2006 where the IC engines are manufactured: on or after July 1, 2007 for engines with a maximum rated power greater than or equal to 500 bhp, except lean-burn engines with a maximum engine power greater than or equal to 500 bhp and less than 1,350 bhp; on or after January 1, 2008, for lean-burn engines with a maximum rated power greater than or equal to 500 bhp and less than 1,350 bhp; on or after July 1, 2008, for engines with a maximum rated power less than 500 bhp; or on or after January 1, 2009, for emergency engines with a maximum rated power greater than 19 kW (25 bhp).

40 CFR 60 Subpart JJJJ requires manufacturers of stationary spark-ignition IC engines to certify that the engines they produce comply with the applicable emission standards for the engine model year and requires owners and operators of stationary spark-ignition IC engines to install and operate spark-ignited IC engines that comply with the emission standards included in 40 CFR 60 Subpart JJJJ by specified dates. The emission limits in 40 CFR 60 Subpart JJJJ do not apply to existing engines that were manufactured before the applicable compliance date.

40 CFR 60 Subpart JJJJ requires new landfill gas-fired spark-ignited IC engines, digester gas-fired spark-ignited IC engines, and emergency stationary spark-ignited IC

engines to comply with a VOC limit of 1.0 g/bhp-hr or 86 ppmv @ 15% O2 as propane (258 ppmv @ 15% O2 as methane) and requires all other stationary spark-ignited IC engines to comply with a VOC limit of 0.7 g/bhp-hr or 60 ppmv @ 15% O2 as propane (180 ppmv @ 15% O2 as methane).

The 90 ppmv @ 15% O2 (as methane) VOC limit for non-emergency spark-ignited IC engines included in the proposed amendments to Rule 4702 is significantly lower than the VOC limits in this regulation, with the proposed VOC limit in Rule 4702 being half of the most stringent VOC requirement in this regulation. In addition, the VOC limit in Rule 4702 will apply to both existing and new engines rather than just new engines.

B. BARCT Evaluation Conclusion

The NOx emission requirements included in Rule 4702 satisfy MSM and BACT/BACM requirements, which require a higher level of control than BARCT; therefore, Rule 4702 satisfies BARCT for NOx.

The VOC emission requirements included in the proposed amendments to Rule 4702 are significantly lower than the VOC emission limits in the majority of rules that apply to similar source categories in other California air districts, including VOC emission limits that have recently and previously been determined to satisfy BARCT. The only exception being the VOC limits in SCAQMD Rule 1110.2, which as discussed above, are actually BACT levels emission limits that are beyond BARCT.

The 90 ppmv @ 15% O2 VOC limit for spark-ignited IC engines included in the proposed amendments to Rule 4702 will significantly reduce the VOC limits required for spark-ignited IC engines without potentially adversely affecting the ability to achieve the necessary NOx emissions reductions, which are critical to attainment of health-based air quality standards in the San Joaquin Valley. Based on this and the comparison to the requirements in other rules and regulations that apply to IC engines, the District has determined that the VOC emission requirements included in the proposed amendments to Rule 4702 meet or exceed BARCT requirements.

III. Evaluation of the Requirements for Source Categories in Proposed Rule 4702

The following paragraphs evaluate the requirements of Proposed Rule 4702 in light of the previous definitions of RACT and BARCT.

A. Emergency Engines and Low-Use Engines

District staff is not proposing any changes to the exemption requirements for emergency standby engines and low-use engines. The existing requirements are consistent with CARB RACT/BARCT Determination for Spark-Ignited Engines and CARB Airborne Toxics Control Measures (ATCM). In addition, the ATCM is already being implemented

through the District's process for issuing Permits to Operate. The exemptions as outlined in the current rule represent RACT and BARCT for these sources.

A. AO Spark-Ignited Engines

As stated earlier, in conjunction with EPA's full approval of the current version of Rule 4702 for inclusion into the SIP, EPA determined that the requirements of Rule 4702 were consistent with EPA regulations, and relevant policy and guidance regarding enforceability, BACM/BACT, and RACM/RACT. Additionally, as a part of the District's 2018 PM2.5 Plan, the District demonstrated that Rule 4702 continued to satisfy BACM and determined that the requirements of Rule 4702 satisfied MSM for NOx and PM precursors. The criteria for BACM/BACT and MSM are stricter than for RACT and BARCT, Therefore the proposed NOx limits of 0.15 g/bhp-hr or 11 ppmv and 0.6 g/bhp-hr or 43 ppmv meets or exceeds RACT and BARCT requirements. As discussed above the proposed VOC limits of the rule also meet or exceed BARCT requirements.

B. Compression Ignited Engines (AO and non-AO)

The current standard for a Non-Compression Ignited engine are tier 3 or 4 engines, with the exception of engines 'greater than 500 bhp and greater than or equal to 1,000 annual operating hours' which has a NOx limit of 80 ppmv. The proposed amendments would remove the 'greater than 500 bhp and greater than or equal to 1,000 annual operating hours' engine category. District staff is not proposing any changes to the requirements for the other engine categories, or any of the Certified Compression Ignited Engines. The requirements for compression-ignited IC engines in the current rule represent RACT and BARCT for these sources.

C. Limited-Use Non-AO Spark Ignited Engines (Rich-Burn and Lean-Burn)

District staff evaluated stationary engines that operate less than 4,000 hours annually and compared the cost effectiveness for the limited-use engines and full-time use engines. Since limited-use engines have fewer emissions on an annual basis, the cost effectiveness for a limited-use engine is higher than for a full-time engine. For this reason, the current rule includes a separate category for limited-use engines. The proposed amendments will reduce the emission limits for limited-use engines to 11 ppmv NOx and VOC limit of 90 ppmv, which are the same emission limits as full-time engines and, as discussed earlier, meet or exceed RACT and BARCT.

D. Waste Gas Fueled Non-AO Spark Ignited Rich-Burn Engines

The current NOx limit in Rule 4702 for non-AO waste gas fueled rich-burn engines is 50 ppmv (at 15% O_2). Waste Gas Fueled Non-AO Spark Ignited engines can achieve levels of control though the use of waste gas cleanup systems and NSCR. The proposed NOx limit of 11 ppmv and VOC limit of 90 ppmv Rule 4702 emission limits for

waste gas-fueled non-AO spark-ignited rich-burn engines are the as the emission limits for full-time engines that are not fueled with waste gas and meet or exceed RACT and BARCT.

E. Cyclic Loaded Field Gas Fueled Non-AO Spark Ignited Rich-Bun Engines

As noted earlier in this report, cyclic-loaded, field gas fueled engines can achieve some level of control. The exhaust gas temperature of cyclic loaded engines varies as a function of the engine load. Catalyst chemistry depends on a minimum temperature to be effective. When the cyclic load engine is operating in an engine load range for which the exhaust gas temperature is within the catalyst's effective range, the emissions are well-controlled, but as the engine cycles out of that range NOx control may be reduced. The proposed NOx limit of 11 ppmv and VOC limit of 90 ppmv for cyclic-loaded, field gas fueled non-AO spark-ignited rich-burn engines are the same emission limits as other full-time IC and meet or exceed RACT and BARCT.

F. 2-Stroke Engines Less than 100 hp Non-AO Spark Ignited Lean-Burn Engines

The category in Rule 4702 of '2-Stroke Engines less than 100 hp' non-AO spark ignited lean-burn engines has a NOx limit of 75 ppmv (at 15% O_2). There are no engines in this category, and as such it would be removed from Table 3 of the Rule (Table 5 of this report) and would no longer be considered a category for future engines after the timeline detailed in Section 7.5 of the rule.

G. Lean-Burn Engine Used For Gas Compression

Most large natural gas-fired lean-burn IC engines in the region are in natural gas distribution and storage service, and these units can experience frequently changing load conditions. The proposed emission limit is achievable through, low-NOx combustion technology, which includes changes to the engine's timing, enhanced control of the air-fuel ratio and other changes that lower NOx emissions. For this reason, and given the prior approval of the existing emissions limitation as RACT for this category, the proposed emission limits of 40 ppmv NOx and 90 ppmv VOC meets or exceeds RACT and BARCT for this source category.

H. Waste Gas Fueled Non-AO Spark Ignited Lean-Burn Engines

The current NOx limit in Rule 4702 for non-AO waste gas fueled lean-burn engines is 65 ppmv or 90% reduction (at 15% O_2). Waste Gas Fueled Non-AO Spark Ignited engines can achieve levels of control though a tune-up of the engine, or the replacement with either a new lean-burn or rich-burn engine. The proposed NOx limit of 40 ppmv and VOC limit 90 ppmv Rule 4702 emission limits for waste gas-fueled non-AO spark-ignited lean-burn engines meets or exceeds RACT and BARCT.

I. Non-AO Spark Ignited Engines, Not Listed (Rich-Burn and Lean-Burn)

The proposed NOx emission limit of 11 ppmv for non-AO spark ignited engines is more stringent than RACT since the engines in question would be required to install advanced add-on controls in order to meet the proposed limit. The proposed emission limit goes beyond RACT and also meets or exceeds BARCT for this source category.

J. Consideration for Prohibitory Rules in Other California Air Districts: South Coast AQMD Rule 1110.2 (Emissions from Gaseous - and Liquid-Fueled Engines)

In considering what benchmarks to use for RACT and BARCT, it is important to evaluate other emission limits that have been imposed on the same source category. The only California air district rule covering the same source category that was found to have potentially more stringent NOx or VOC emission limits than those proposed in Rule 4702 was South Coast AQMD (SCAQMD) Rule 1110.2. District staff reviewed SCAQMD Rule 1110.2, which applies to IC engines. SCAQMD Rule 1110.2 includes stringent NOx, CO, and VOC emission limits for IC engines. As discussed above, SCAQMD has determined that the current emission requirements of SCAQMD Rule 1110.2 are equivalent to BACT. The SCAQMD emission limits for NOx and VOC are also comparable to the emission limits required as BACT in several other California air districts. Because the SCAQMD Rule 1110.2 emission limits are equivalent to BACT, these emission limits go far beyond what is required by RACT and BARCT in the San Joaquin Valley. However, the District has still adopted a similar NOx limit for the majority of sources subject to Rule 4702 and is proposing to significantly lower the VOC emission limit in the rule to levels that will be lower than the levels required by rules in almost all other California air districts with the exception of SCAQMD.

It also must be noted that the SCAQMD's Regional Clean Air Incentives Market (RECLAIM) program currently exempts IC engines at RECLAIM facilities from the NOx emission limits of SCAQMD Rule 1110.2. Although the recent amendments to SCAQMD rules set a schedule for IC engines at RECLAIM facilities to comply with SCAQMD Rule 1110.2 by December 31, 2023, currently many facilities in the SCAQMD remain exempt from the requirements of the rule. Therefore, the emission limits of SCAQMD Rule 1110.2 cannot be directly compared to limits in District rules that do not have similar exemptions to the rule requirements. Also, even when the SCAQMD RECLAIM facilities begin to comply with the SCAQMD Rule 1110.2, it does not change the fact that the emission limits in the rule are beyond RACT and BARCT and more comparable to BACT, as discussed above. In addition, the San Joaquin Valley has many IC engines that have different uses than the types of IC engines that are subject to SCAQMD Rule 1110.2; for example, SCAQMD staff previously informed the District that there were are only two rich-burn agricultural IC engines and no lean-burn agricultural IC engines operating in SCAQMD. Information from the SCAQMD also indicates that there are no stationary diesel IC engines that are subject to the emission requirements of SCAQMD Rule 1110.2. Therefore, the emission limits in SCAQMD

Rule 1110.2 have not been demonstrated in practice for several types of IC engines that operate in the San Joaquin Valley, which further supports that the emission limits of SCAQMD Rule 1110.2 are beyond RACT and BARCT for these engines.

IV. Conclusion

Since the previous rule was determined to meet RACT and this amendment further strengthens the rule requirements, this rule is expected to establish requirements well beyond RACT, and thus satisfies RACT. In addition, based on the evaluation of other applicable rules for this source category, District staff concludes that the proposed rule limits fulfill or exceed BARCT requirements for IC engines.

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